

2. Data Collection Quality Assurance Plan

This Data Collection Quality Assurance Plan (DCQAP) provides a comprehensive plan to document all sampling, field measurements, and sample analyses to be performed during the RFI in order to ensure that all information, data, and resultant decisions are technically sound, valid, and properly documented.

The DCQAP has been prepared in accordance with the RFI Scope of Work Outline included as Attachment B of the Order. The plan is divided into four major sections describing (1) data collection strategy and intended uses, (2) data quality assurance objectives, (3) sampling procedures, (4) field measurements, and (5) sample analysis.

2.1 Data Collection Strategy and Intended Uses

Due to the size of the facility (588 acres) and the complexity of the industrial operations, the Steubenville East Coke Plant has been divided into eight sectors (Sectors A through H) for investigative purposes (Figure 5) as discussed in the Project Management Plan. These sectors were defined based on similar wastes managed or by similar processes within each area. For each sector, WPSC identified Solid Waste Management Units (SWMUs) that may have the potential to impact the environment.

The data collection strategy is designed to assess the environmental conditions at each sector rather than at each individual SWMU and includes two major components:

- a focused investigation of areas with potential associated releases identified; and,
- an “outside-in” perimeter investigation by sector.

This approach accomplishes the goal of targeting those areas with potential associated releases and focusing resources at this complex facility to areas within each sector that may require additional assessment. Additionally, through the perimeter assessment component, this approach provides an efficient means to evaluate each sector for previously unknown potential releases.

- The areas with potential associated releases previously identified at the facility in the DOCC include the following:

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- Former Allied Number 6 Fuel Oil Storage Area (SWMU A-1);
- Byproducts Area (Sector B);
- COG Drip Legs that formerly discharged to the ground surface (SWMUs A-14, B-30, C-20, E-4, F-4, and H-12); and
- DTTS Material Management Areas:
 - Former DTTS Staging Area/Hatcher's Pad (SWMU D-2)
 - BOF Residuals Storage Area (SWMU E-1)
 - Plant Debris Area (SWMU E-2)
 - Former Ash Screening Area (SWMU E-3)
 - Former Hillside Disposal Area (SWMU H-1)

The areas with minor potential for associated releases as identified in the DOCC include the following:

- Light Oil Refining Area (SWMU A-7);
- Former Tank Car Cleaning Area (SWMU A-12); and
- Provenzano Trucking Leased Parcel (SWMU H-8)

WPSC has utilized information gained through past environmental assessment activities (as summarized within the DOCC and this workplan) in the formulation of the scope of work for the RFI. Many areas of the facility are currently and have historically been used for the storage of coal and metallurgical-grade coke. These materials are not viewed as contributing significantly to potential releases to the environment. Therefore, these areas will be investigated using existing hydraulically downgradient groundwater monitoring wells, to the extent possible.

The proposed data collection activities are focused on the perched groundwater aquifer and the alluvial groundwater aquifer and do not address surface water at the Ohio River or bedrock groundwater. The Ohio River and bedrock groundwater media would be addressed as part of a Phase II investigation, only if determined to be appropriate and necessary based upon the results of this Phase I investigation.

The proposed data collection activities include collecting soil, ground-water, surface water/sediment and “tar” seep samples as summarized on Tables 6 and 7 and illustrated on Figures 5 and 6. Data collected as part of the RFI will be utilized to:

- identify areas of the facility that require no further action;
- identify areas of the facility requiring additional delineation as part of a Phase II investigation;
- identify areas of the facility that may require remedial action;
- prepare a baseline risk assessment, and
- perform an evaluation of intrinsic bioremediation processes that are occurring.

2.2 Data Quality Assurance Objectives

The overall data quality assurance objectives for analysis of soil, surface water/sediment, groundwater, and seep samples are to ensure that resultant data are precise, accurate, representative, comparable, and complete (PARCC). The quality assurance objectives will be evaluated based upon the requirements for data quality objectives (DQOs) as outlined in the USEPA SW-846 methods to be employed. The remainder of this section describes the DQOs for this project and outlines the methodology for their assessment. The evaluation of DQOs is also summarized on Table 8 and further detailed in the Pace and Microseeps laboratory Standard Operating Procedures (SOPs) and Quality Assurance Plans included as Appendix D.

2.2.1 Precision

Precision is defined as an estimate of the reproducibility of a method and/or collection procedure. Information regarding the precision of chosen methods will be ascertained by analyzing replicate (field), duplicate, matrix spike, and matrix spike duplicate samples at a frequency of 5 percent (1 per 20 primary samples) of the samples of a given matrix and analysis. Specific statistical comparison of replicate data from field and laboratory measurements, as a means of evaluating precision of both sample collection procedures and laboratory performance, may be accomplished by first comparing the obtained replicate results with the published EPA criteria for method precision, found in the appropriate USEPA SW-846 Method. If not available for a given method, the relative percent difference (RPD) may be calculated and compared to the published laboratory precision criteria.

2.2.2 Accuracy

The accuracy of a method is an estimate of the difference between the true value and the determined mean value. Certain Quality Assurance (QA) parameters such as laboratory control samples, lab spike samples, matrix spikes and surrogate spike samples all have known concentrations prior to analysis. By comparing the percent recovery results to the known true value, it is possible to measure the accuracy of the analysis. In routine practice, the laboratory will collect the data for each of these parameters for a period of at least 20 measurements. The results of these 20 measurements will be calculated. Then, based on the desired level of confidence, two or three standard deviation ranges will be established as practical control limits. To be valid, these control limits must meet the accuracy limits specified in the SW-846 method for each compound. If the determined control limits are within the range established for the compound and method by SW-846, then the determined range becomes the practical control limit used by the laboratory until another set of data is developed and new control limits are calculated.

Specific statistical comparison of percent recovery values reported by the laboratory, as a measure of method accuracy will be compared with the published USEPA criteria for the accuracy of an individual method, as stated in SW-846.

2.2.3 Representativeness

Samples collected during field activities associated with the WPSC RFI will be representative of the population from which they were collected. Representativeness is defined as the degree with which the data collected accurately and precisely characterizes a population, a parameter of interest, variations at a sampling point, a process, or an environmental condition.

- Attainment of representative samples will be facilitated by utilizing appropriate sample collection and handling procedures presented as SOPs in Appendix E. Additionally, representativeness of specific samples will be achieved by the following protocols:
- appropriate sample number and location selection to adequately characterize the actual and current site conditions,
- appropriate sampling procedures and equipment will be utilized,
- appropriate selection of analytical methodologies that ultimately provide required detection limits for assessment of DQOs,
- appropriate selection of analytical parameters,

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- collection of the appropriate number of QA/QC samples to verify proper functioning of analytical equipment,
- documentation of sampling activities and sampling locations in field logs, on chain-of-custody forms, and in laboratory books that are signed and dated by sampling and analysis personnel, and
- proper sample preparation in the field and also in the laboratory.

2.2.4 Comparability

Comparability, as used within this DCQAP, is understood as being the confidence with which one data set can be compared to another. To ensure data set comparability, the following steps will be taken:

- maps showing locations of sampling stations will be prepared, reviewed and made consistent with the proposed sampling event(s),
- chemical parameters will be analyzed following standardized methods approved by USEPA,
- techniques utilized to collect samples will be standardized and documented in SOPs,
- standardized units will be used to report field and laboratory analytical results, and
- the level of QA/QC will be defined based on standardized criteria.

2.2.5 Completeness

Data completeness is defined both as the percentage of total tests conducted that are deemed valid and also as the percentage of the total tests required in the scope of work that are deemed valid. Specific criteria for data completeness are presented in Table 8.

2.2.6 Methods for Assessment of Data Quality Objectives

2.2.6.1 *Field Data*

In this investigation, soil and groundwater samples will be collected and several parameters will be field measured as summarized on Table 9. Data collected will be

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reported in USEPA-approved units to enable comparability with existing data sets. Efforts to ensure that the data obtained are representative, accurate and precise will be monitored using several QA controls.

The accuracy of data produced by field instruments will be maintained and documented by performing initial and continuing calibrations with known standards in accordance with specified SOPs (Appendix E) and/or as specified in the instrument's Operating Manual. Precision will be determined through the analysis of replicate samples. Representativeness of samples will be maintained throughout the RFI by collecting a variety of field measurements and through careful adherence to outlined SOPs (Appendix E). The completeness of the field data will be assessed through careful evaluation of sample analysis documentation and adherence to specified parameter measurements.

2.2.6.2 Laboratory Data

Chemical analyses for the WPSC RFI performed under USEPA SW-846 have specific criteria for analytical precision. In general, the precision requirements are based on results from duplicate analyses, matrix spikes, matrix spike duplicates, internal standards, and surrogate standards. The reader is referred to specific SW-846 Methods for details concerning established precision limits.

Chemical analyses performed under guidelines specified in SW-846 must meet specific accuracy requirements. Specified criteria for organic and inorganic analyses include, but are not limited to, instrument tunings (GC/MS organics), calibrations, continuing calibrations, QC check samples, internal standards, etc. The reader is referred to appropriate SW-846 Methods for details concerning the specified criteria.

Representative sampling locations have been chosen to provide adequate information concerning potential sources of contamination and its specific chemical nature. This will be accomplished by following the specified sampling regiment discussed in the Task Plan for the RFI (Section 1.8 of the Project Management Plan).

Soil and groundwater samples will be collected and analyzed according to USEPA-approved methods. Data generated from laboratory analyses will be reported in standard units that are approved by the USEPA. Data reported in standard units will then be comparable to existing data sets. Information concerning laboratory accuracy, precision, representativeness and completeness will be assessed through the analysis of several laboratory QC samples and additional "blind" QC samples prepared in the field. The quality assurance/quality control (QA/QC) acceptance criteria to be employed for

this project will comply with or exceed the QA/QC control limits established by USEPA SW-846 Methods

Completeness of the sampling data will be determined by comparing sample analyses requested and samples collected to laboratory tracking forms and reported analyses. Refer to Table 8 for established criteria concerning data completeness.

2.3 Field Investigation Overview

This section presents an overview of the field investigation and sampling methodologies to be performed at various site locations

The available environmental data collected to date was reviewed during preparation of this RFI Workplan. Additionally, several site reconnaissance visits were performed to locate the existing well network and assess existing physical conditions at facility Site. The following field investigation activities are designed to provide sufficient data to meet the investigation objectives.

The proposed field investigations include collecting ground-water, surface water/sediment and “tar” seep data. The proposed field activities are summarized in Tables 6 and 7 and are illustrated on Figures 5 and 6. The proposed field activities for the RFI represent Phase I activities only. It is feasible that Phase II activities may be required. The scope of Phase II activities would be determined based on the results of the Phase I activities. Phase II activities could include:

- Additional groundwater monitoring wells;
- Additional groundwater quality analysis; and/or,
- Treatability testing.

The proposed Phase I field activities are focused on the perched groundwater aquifer and the alluvial groundwater aquifer. The proposed Phase I field activities do not address surface water at the Ohio River or bedrock groundwater. The Ohio River and bedrock groundwater media will be addressed as part of Phase II only, if determined to be appropriate and necessary.

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Many of the RFI sectors will be investigated utilizing geoprobe sampling techniques. If geoprobe techniques cannot be utilized due to subsurface obstructions or other difficulties, hollow-stem auger techniques will be utilized. Geoprobe borings will extend to the uppermost saturated zone (whether perched or alluvial), but will not penetrate through the perched zone into the alluvial aquifer. If product is encountered during Phase I field investigation activities, the Phase I field program will be expanded so that the extent can be assessed using geoprobe or other techniques.

Environmental samples collected as part of the field investigations will be submitted to an analytical laboratory for analysis as described in Section 2.5 entitled, Laboratory Analytical Methods Summary. The rationale for the choice of sampling parameters and protocol is summarized in Section 1.7 entitled, Technical Approach to Site Investigation and further detailed in this Data Collection Quality Assurance Plan. Detailed field procedures are also presented in applicable sections of this Data Collection Quality Assurance Plan and Appendix E, entitled, Standard Operation Procedures.

The subtasks included in the field investigation task include:

- Subtask 2.1 - Geoprobe Soil Borings/Groundwater Samples
- Subtask 2.2 – Soil Sampling/Groundwater Monitoring Well Installation
- Subtask 2.3 – Hillside Soil Gas Sampling
- Subtask 2.4 – Hillside Soil Borings and Wells
- Subtask 2.5 – Survey Wells and Mahan's Run
- Subtask 2.6 – Sample "Tar" Seeps
- Subtask 2.7 – Water Level Measurements
- Subtask 2.8 – Monitoring Well Development
- Subtask 2.9 – Surface Soil Sampling
- Subtask 2.10 –Groundwater Sampling
- Subtask 2.11 – Surface Water/Sediment Sampling
- Subtask 2.12 – Slug Testing
- Subtask 2.13 – Environmental Site Assessments

2.4 Field Investigation Sampling Requirements

Sampling and related activities are to be performed as prescribed in this section. Through implementation of these prescribed procedures, samples will be collected and controlled in a manner to promote sample integrity and representativeness. Field documentation, equipment calibration, sample collection procedures, and sample management, and decontamination of field equipment.

2.4.1 Field Documentation

The following sections specify the procedures that shall be followed to ensure that the collection of environmental data is properly recorded for future reference and interpretation. The objective of field record keeping is to establish uniform methods of maintaining and preserving record that contain observations, measurements, and other documentation of field conditions.

Documentation includes bound field logbooks and/or field data sheets, sample labels, sample custody seals, and chain-of-custody records. All sample documentation shall be recorded in permanent ink. Errors will be crossed out with a single line, dated and initialed. Photographs and drawings may also be used to document site conditions and accomplished work elements.

2.4.1.1 Field Notebook

The site logbook is the master field investigation document and is required for all projects. It is a bound book with hard cover and sequentially numbered pages. Ring binders or similar binding types do not constitute a bound logbook. Its primary purpose is to contain within one document the actual field data or references to other field documents that contain a specific description of every activity that has occurred in the field on any given day.

The site logbook also contains any administrative occurrences, conditions, or activities that have affected the fieldwork for any given day or field task. All sampling activities will be recorded in a bound field notebook with numbered pages. Entries will be dated, legible, written in permanent ink, and will contain accurate and inclusive documentation of project activities. The front of the logbook lists the project number and the name, the investigation, the client, and the dates of use. The site logbook is kept up to date on a daily basis. The site logbook includes the following information:

- Time of arrival at and departure from the Site;

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- Names and titles of personnel present onsite;
- Names, titles and organization of any visitors who entered the site during the day;
- Level of safety protection used each day, including changes in level of safety protection;
- Instrument ID numbers and instrument readings;
- Reference to other field forms containing more specific field information
- Shipping arrangements (e.g., Federal Express air bill number);
- Names of all personnel on the sampling team;
- Signatures of persons making log entries;
- General descriptions of weather conditions;
- Location of each sampling point;
- Date and time of sample collection;
- Field observations and descriptions of problems encountered; and
- Duplicate and laboratory QC sample locations and sample collection methods.

2.4.1.2 Field Data Log Sheets

The following field forms have been developed for use in recording data collected in the field:

- Field instrument Calibration Form;
- Unconsolidated Boring Log;
- Sample/Core Log;
- Well Construction Log – Unconsolidated;
- Well Construction Log – Intermediate;
- Well Construction Log – Bedrock;
- Groundwater Sampling Form;
- Surface Water Sampling Log;
- Water Level/Pumping Test Record;
- Water Level Measurement Form;

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- Monitoring Well Development Log;
- Soil/Sediment Sample Log;
- Soil Sample Log;
- Sample Labels;
- Custody Seal; and,
- Chain-of-Custody.

2.4.1.3 Field Equipment Log Book

The purpose of the Field Equipment Logbook (FEL) is to document the proper use, maintenance, and calibration of field testing equipment. The FEL is usually a three-ring binder book into which calibration log sheets are placed for each calibrated piece of equipment. A calibration log sheet shall be maintained for each instrument used onsite and shall be kept in the FEL. The following items shall be tracked in the FEL:

- Equipment calibration status;
- Equipment decontamination status;
- Equipment non-conformance; and
- Equipment inspection and repair records.

The sampling technician using, maintaining or calibrating field equipment shall document his/her actions in the FEL. Entries shall contain the following:

- Names and signature of sampling technicians;
- Date of entry;
- Name of equipment and its identifying number;
- Decontamination status;
- Nature of work conducted;
- List of reference of procedure(s) used for calibration or maintenance;
- Manufacturer, lot number and expiration data of calibration standards;
- Measurement results (acceptable or unacceptable).

2.4.1.4 *Sample Labels, Custody Seals and Chain-of-Custody Forms*

Each sample container will be labeled either with a preprinted or handwritten label with the project name and number, complete sample identification, date and time collected, sampler name, and analysis requested. Each cooler will have a least one custody seal that is dated and signed and a chain-of-custody form that is fully completed and signed. See Appendix F for examples of these standard forms.

2.4.2 Field Equipment Calibration

Field equipment to be used during RFI includes the following:

- Photoionization detector (PID),
- Water-level measurement instrument,
- pH meter,
- Specific Conductance meter,
- Redox Meter
- Turbidity meter,
- Thermometer,
- Dissolved oxygen meter; and,
- ORP Interphase Probe.

The field equipment shall be calibrated at least daily according to the manufacturer's specifications. Instruments and manufacturers' instructions and specifications are maintained in the project files. The proper calibration and documentation of field equipment are designed to assure that the field equipment is functioning optimally. The FEL will be used to record usage, maintenance, calibration, and repair.

2.4.3 Field Investigation Techniques and Sample Collection

This section describes the procedures for collecting soil and groundwater samples for the WPSC RFI.

2.4.3.1 Permitting and Utility Clearance

Permits that may be required to complete the RFI include:

- Utility clearance;
- Boring and monitoring well installation;
- Boring and/or monitoring well abandonment;
- Waste transport and disposal

All permits associated with the clearance of utilities will be obtained by WPSC. The CEC Field Operations Leader will be responsible for coordinating this effort with WPSC. The driller will obtain all permits associated with the installation or abandonment of borings and/or monitoring wells. The Field Operations Leader will be responsible for coordinating this effort with the driller. Waste transport and disposal permits will be the responsibility of WPSC. The Field Operations Leader will coordinate with WPSC as necessary regarding these permits.

CEC and WPSC will collectively mark the proposed sampling locations with white spray paint, a stake, or suitable equivalent and the proposed sampling locations will be cleared for utilities by WPSC. The utility clearance will be coordinated with WPSC, and is anticipated to be completed approximately one week prior to the start of sample collection. Following field marking of the proposed sampling locations, the utility surveyor will perform a subsurface utility clearance at each of the proposed sample locations. This will include marking all identified underground utilities within a 2 to 3 foot radius at each of the locations. CEC and WPSC will review the utility locations prior to commencing field work, and any proposed boring locations at which underground utilities are present will be relocated. Old location markers will be painted over, and the new location will be marked .

2.4.3.2 Geoprobe Soil Borings/Groundwater Samples

Up to 31 direct-push soil borings will be advanced across the site at locations that correspond to specific target areas within each Sector (Figure 5 and 6, Table 6 and 7) as follows:

- Sector A – 11 geoprobe locations
- Sector C – 1 geoprobe location

- Sector D – 2 geoprobe locations
- Sector E – 8 geoprobe locations
- Sector F – 1 geoprobe location
- Sector G – 2 geoprobe locations
- Sector H – 6 geoprobe locations

Soil samples will not be collected from the direct-push boring at Sector E-3 Former Ash Screening Area; only a groundwater sample will be collected at this location.

2.4.3.2.1 Direct-Push Soil Boring Installation

The direct-push technique will be used to install each soil boring at locations illustrated on Figures 5 and 6. Each boring will be advanced until the uppermost water-bearing zone is encountered, but will not be advanced through the perched aquifer zone into the alluvial aquifer zone. Macrocore soil core samples will be collected continuously at each boring.

The acetate Macrocore sample liners will be removed from the 4-foot barrel sampler upon retrieval from the borehole. The acetate core will be split down the middle and the entire core will be divided in half using a stainless steel knife. The entire core interval will be field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID) in accordance with the Standard Operating Procedure presented in Appendix E. Organic vapor readings will be used as a guide to determine intervals to be sampled for laboratory analytical testing. The core sample will be classified by the field geologist for gross composition, texture, color, relative degree of saturation, and other observable characteristics, at a minimum, in accordance with the Uniform Soil Classification System ASTM Method D-2487 (ASTM, 1991d).

The soil description will be recorded on a Sample/Core Log (Appendix F). Each boring will be abandoned by filling the annulus with hydrated bentonite pellets, after a groundwater sample has been collected, as described in the following sections.

2.4.3.2.2 Direct-Push Soil Sampling

Prior to sampling at each location, the sampling assembly will undergo a multi-step decontamination procedure. The soil-core sampler will initially be brushed to remove any residual soil from the previous sampling location and washed with a laboratory-grade detergent, rinsed with tap water, then rinsed with distilled water. A stainless-

steel container and spoon will be used for compositing samples, and will be decontaminated following the same procedure prior to each use.

Soils will be sampled from selected intervals in each of the direct-push soil borings. To determine concentration profiles, soil samples from at least two and perhaps three intervals (near surface, mid-point and above the uppermost water-bearing zone) will be collected and submitted for laboratory analysis. Near surface samples will be collected from the top 12 inches below the ground surface. The deeper soil sample(s) will be selected using visual observations and PID readings. A soil sample from the mid-point will not be collected and submitted for laboratory analysis unless visual observations and/or PID reading indicate contamination. If the soil sample for a given interval (i.e., near surface, mid-point and above the uppermost water-bearing zone) is collected from an area that represents more than 6-inches of the core barrel, then the soil from the core barrel that represents the zone to be sampled will be placed in a stainless steel bowl and mixed to composite the area prior to placing the sample in the appropriate sampling jars. Samples for volatile organic analysis will not be mixed and samples will be collected directly from the core and placed in the appropriate containers.

All direct-push soils samples will be analyzed for modified TCL constituents. Sample containers, volumes and preservation methods are specified in Table 10.

Sample collection for VOCs will follow procedures outlined in USEPA Method 5035 for natural fine-grained soils. For natural soils with large rock fragments or cobbles, or for fill materials (slag, etc.) that are not conducive to sampling with a syringe or Encore sampler, samples will be collected by using the procedure described in SOP Nos. 3 and 4 in Appendix E.

To assess data reproducibility and laboratory performance, duplicate soil samples will be collected at a frequency of 1 in 20. Duplicate samples will be prepared by splitting soil composited in a stainless-steel container and filling two sets of sample containers. If additional sample volume is needed to fill two sets of sample containers, additional soil samples will be collected at the next sampled interval.

To assess the effectiveness of the decontamination procedure, rinsate blanks will be prepared during the soil sampling activities at a frequency of 1 in 20. The rinsate blank will be prepared by washing the sampling equipment as described above, then thoroughly rinsing the equipment with deionized water into the compositing container. The rinsate will then be collected from the compositing container for laboratory

analysis using the same methodology employed for the soil samples. Preparation and collection of the field duplicate and field rinsate samples will be documented on the appropriate logs.

Protocol and procedures associated with collecting direct-push soil samples are presented in Appendix E, entitled Standard Operating Procedures.

2.4.3.2.3 Geoprobe Groundwater Sampling

Each of the soil borings installed will be modified to collect groundwater samples utilizing a Geoprobe^R screen point groundwater sampling apparatus. The Geoprobe^R screen point groundwater sampling apparatus consists of a retractable drive point that is driven to the desired interval and retracted to expose a section of small diameter well screen. The screened interval is then accessed through the hollow drive-point rod assembly.

Groundwater samples will be collected one (1) time from each screen point installed. Each sampling point will be evacuated using a peristaltic pump fitted with tubing connected to a flow-through device. All geoprobe groundwater samples will be collected following low-flow sampling procedures, to the extent possible, described in Appendix E. During evacuation, the appropriate sample containers will be prepared and labeled. Sample containers, volumes, and preservation methods are specified in Table 10. The container label will include: sample identification number; sampling personnel; date and time of collection; project number/name; and, analyses requested. Each sample will be collected directly from the evacuation tubing, but after the flow-through device. New tubing will be used between each sampling point. The flow-through device will be decontaminated between each location using the procedure described above for the soil sampling equipment.

All direct-push groundwater samples will be submitted for modified TCL constituents and biogeochemical parameters. Samples collected for metals analysis will include both dissolved (field filtered) and total (unfiltered). The water sample will be collected and transferred to appropriate sample containers in the following order:

1. VOCs;
2. SVOCs;
3. PAHs;
4. Total metals;

5. Dissolved metals;
6. Cyanide and ammonia; and
7. Biogeochemical parameters.

For samples to be analyzed for dissolved metals, filtration will be conducted in the field either inline or immediately after collection using a 0.45-micron membrane filter following the SOP presented in Appendix E. After the sample is filtered, it will be preserved following the requirements identified in Table 10.

Upon completion of groundwater sample collection, field water quality parameters will be measured and recorded. Water odor, clarity, and color will also be described. The samples will then be stored, packaged, and shipped to an appropriate laboratory as described in Section 2.4.6, entitled Field Sample Management.

To assess data reproducibility and laboratory performance, duplicate groundwater samples will be collected at a frequency of 1 in 20. Duplicate samples will be prepared by alternately filling bottles by parameter group for two sets of sample containers.

Sampling personnel will complete a Water Sampling Log for each sampling location. Each log completed at the time of sampling will include the physical appearance of samples, field observations, results of field analyses, sampling methods and materials, constituents analyzed, sampling personnel, and sample container and preservation type. Samples will be transported to the analytical laboratory following standard chain-of-custody procedures. The samples will be shipped overnight to the laboratory in a cooler at 4°C. Protocol and procedures associated with collecting Geoprobe groundwater samples are presented in Appendix E, entitled Standard Operating Procedures.

2.4.3.2.4 Alternate Geoprobe Soil/Groundwater Sampling Methodology

It is possible that the Geoprobe soil/groundwater sampling methodology presented above may not be applicable at the WPSC due to unfavorable subsurface site conditions. Much of the site is covered with fill material. If large, hard, solid objects, such as bricks, concrete, cobbles are present, it may not be feasible to advance the geoprobe Macrocore sampling device. In addition, if the subsurface hydraulic conductivity is relatively “low”, it may not be feasible to collect a groundwater sample using the geoprobe groundwater sampling device.

If the geoprobe Macrocore soil sampling device proves to be unsuccessful, a 4.25-inch diameter hollow-stem auger will be advanced to collect continuous split-spoon samples for soil characterization. In order to collect a groundwater sample, a two-inch diameter, temporary well point will be installed in the borehole. The temporary well point will consist of 2-inch diameter, dedicated 40, 0.10 slot PVC well screen (5 to 10 feet in length) and riser casing. The well screen will be covered by a prefabricated filter sock to minimize the turbidity in the well. A groundwater sample will then be collected following the low-flow sampling procedure also presented in Appendix E. Due to the potential turbid nature and slow production rate of temporary well points, the low-flow sampling procedure may need to be modified in order to collect sufficient water to fill the required bottle set.

If the geoprobe Macrocore sampling device is successfully advanced into the water table, but the geoprobe groundwater sampling technique proves to be unsuccessful, then a temporary well point will be installed and a groundwater sample will be collected as described in the previous paragraphs.

2.4.3.3 HSA Soil Sampling/Groundwater Monitoring Well Installation

A total of 15 soil borings will be installed using hollow-stem auger (HSA) split-spoon sampling technique; subsequently 34 groundwater monitoring wells will be installed using hollow-stem auger techniques at the following locations, which are illustrated on Figures 5 and 6 and detailed in Tables 6 and 7:

- Sector B – 8 cluster well locations - 19 wells
- Sector C – 4 cluster well locations – 8 wells
- Sector D – 3 cluster well location – 7 wells

A 4.25-inch diameter hollow-stem auger soil boring will be advanced until the uppermost water-bearing zone is encountered, but will not be advanced through the perched aquifer zone into the alluvial aquifer zone. This soil boring will later be converted into either a perched aquifer zone monitoring well or an upper alluvial aquifer zone monitoring well depending on which aquifer zone it has penetrated.

Hollow-stem augers are a type of powered auger used primarily to advance the borehole when soil sampling is required. The hollow-stem auger consists of (1) a section of seamless steel tube with a spiral flight to which are attached a finger-type cutter head at the bottom and an adapter cap at the top, and (2) a center drill stem composed of drill rods to which are attached a center plug with a drag bit at the bottom

and an adapter at the top. The adapters at the top of the drill stem and auger flight are designed to allow the auger to advance with the plug in place. As the hole is drilled, additional lengths of hollow-stem flights and center stem are added. The center stem and plug may be removed at any time during the drilling to permit disturbed, undisturbed, or core sampling below the bottom of the cutter head by using the hollow-stem flights as casing. This process also permits the use of augering in loose deposits below the water table. Where this technique is used in unconsolidated material below the water table, fluids of known chemical quality may be used to control ground-water inflow. Undisturbed samples taken in this manner may be more useful than those taken from a cased hole, since the disturbance caused by advancing the auger is much less than that caused by driving the casing.

At each location a second borehole will then be advanced using hollow-stem augers for the purpose of installing a steel surface casing into the fine-grained zone that separates the perched aquifer zone and the alluvial aquifer zone. Continuous split-spoon sampling will be initiated at a depth consistent with the depth that split-spoon sampling was terminated for the first soil boring. This boring would be used to install an upper alluvial aquifer monitoring well.

At four locations (3 in Sector B and 1 in Sector D – see Figures 5 and 6) a third borehole will be advanced using hollow-stem augers for the purpose of installing a monitoring well in the lower alluvial aquifer zone. Steel surface casing will again be installed and keyed into the middle or lower portion of the alluvial aquifer zone. Continuous split-spoon sampling will be initiated at a depth consistent with the depth that split-spoon sampling was terminated for the second soil boring.

2.4.3.3.1 HSA Soil Borings

Continuous split-spoon samples will be collected (ASTM 1586), driven by a 140 lb. Hammer, falling 30-inches. The split-spoon sampler will be 24-inches long, with a flap valve or basket type retainer for positive recovery of the sample. The split-spoon will be opened and the soil core will be divided in half using a stainless steel knife. The entire core interval will be field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID) in accordance with the Standard Operating Procedure presented in Appendix E. Organic vapor readings will be used as a guide to determine intervals to be sampled for laboratory analytical testing. The core sample will be classified by the field geologist for gross composition, texture, color, relative degree of saturation, and other observable characteristics, at a minimum, in accordance with the Uniform Soil Classification System ASTM Method D-2487 (ASTM, 1991d).

The soil description will be recorded on a Sample/Core Log (Appendix F).

2.4.3.3.2HSA Soil Sampling

Prior to sampling at each location, the split-spoon sampling assembly will undergo a multi-step decontamination procedure. The split-spoon sampler will initially be brushed to remove any residual soil from the previous sampling location and washed with a laboratory-grade detergent, rinsed with tap water, then rinsed with distilled water. A stainless-steel container and spoon will be used for compositing samples, and will be decontaminated following the same procedure prior to each use.

Soils will be sampled from selected intervals in each of the HSA soil borings. To determine concentration profiles, soil samples from at least two and perhaps three intervals (near surface, mid-point and above the uppermost water-bearing zone) will be collected and submitted for laboratory analysis. Near surface samples will be collected from the upper 12 inches of soil below the ground surface. The deeper soil sample(s) will be selected using visual observations and PID readings. A soil sample from the mid-point will not be collected and submitted for laboratory analysis unless visual observations and/or PID reading indicate contamination. In addition to samples collected from the upper aquifer, one sample will be collected from the confining layer that separates the perched and alluvial aquifers at each nested well location. If the soil sample for a given interval (i.e., near surface, mid-point and above the uppermost water-bearing zone) is collected from an area that represents more than 6-inches of the split-spoon barrel, then the soil from the split-spoon barrel that represents the zone to be sampled will be placed in a stainless steel bowl and mixed to composite the area prior to placing the sample in the appropriate sampling jars. Samples for volatile organic analysis will not be mixed and samples will be collected directly from the core and placed in the appropriate containers.

Sample collection for VOCs will follow procedures outlined in USEPA Method 5035 for natural fine-grained soils. For natural soils with large rock fragments or cobbles, or for fill materials (slag, etc.) that are not conducive to sampling with a syringe or Encore sampler, samples will be collected by using the procedure described in SOP Nos. 3 and 4 in Appendix E.

All split-spoon soil samples will be submitted for modified TCL constituents. Sample containers, volumes and preservation methods are specified in Table 10.

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Up to six (6) split-spoon sample locations will be selected and sampled to characterize the aquifer hydraulic properties. Two samples each will be collected from the perched aquifer zone, the upper alluvial zone and the lower alluvial zone and submitted for:

- Porosity;
- Grain size;
- Moisture content;
- Total organic carbon; and,
- Bulk density.

The location and depth of each soil sample for physical analysis will be determined in the field with the objective of identifying sampling locations that are representative of conditions across the site.

To assess data reproducibility and laboratory performance, duplicate soil samples for chemical analysis will be collected at a frequency of 1 in 20. Duplicate samples will be prepared by splitting soil composited in a stainless-steel container and filling two sets of sample containers. If additional sample volume is needed to fill two sets of sample containers, additional soil samples will be collected at the next sampled interval.

To assess the effectiveness of the decontamination procedure, rinsate blanks will be prepared during the soil sampling activities at a frequency of 1 in 20. The rinsate blank will be prepared by washing the sampling equipment as described above, then thoroughly rinsing the equipment with deionized water into the compositing container. The rinsate will then be collected from the compositing container for laboratory analysis using the same methodology employed for the soil samples. Preparation and collection of the field duplicate and field rinsate samples will be documented on the appropriate logs.

Protocol and procedures associated with collecting split-spoon soil samples are presented in Appendix E, entitled Standard Operating Procedures.

2.4.3.3.2.1 Shelby-tube sampling

In addition, two shelly tube and two split-spoon samples will be collected from the aquitard separating the perched aquifer zone and the upper alluvial zone and analyzed for the following list of parameters:

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- Porosity;
- Grain size;
- Moisture content;
- Total organic carbon;
- Bulk density; and,
- Permeability.

The purpose of obtaining a shelby-tube sample is to obtain a high-quality undisturbed sample for falling head permeability analysis. The sampler is constructed of cold drawn steel tubing about 1mm thick. The lower end is bent to form a tapered cutting edge. The sample will be obtained by pushing the tube hydraulically in one continuous movement with the drill rig. The maximum hydraulic pressure is recorded. At the end of the designated push interval and before lifting the sample, the tube is twisted to break the bottom of the sample.

Upon recovery of a thin-walled tube, the actual length of sample is measured and recorded (excluding slough or cuttings). At least ½ inch of soil is cleaned from each end of the tube, and the ends of the soil sample are squared off. Usually the top of the sample will contain cuttings or slough. These must be removed before sealing. The soil that has been cleaned from the tube can be used for a visual classification of the sample. The resulting space at each end of the tube is filled with melted sealing materials, such as approved wax, or with expandable packers. Previously decontaminated Teflon or stainless steel plugs are also used. After this initial sealing, a dry filler such as cuttings, sand, or paper can be placed in the remaining void areas, and sealing is again conducted. This filler prevents that sample from breaking the initial end seals during handling and shipment. The ends of the tube are then closed with tight-fitting metal or plastic caps, and the seam between the cap and tube is wrapped with tape. Finally, the ends are dipped in hot wax, completely covering the tape to ensure sealing.

The sample container and the top cap are labeled by writing on them with an indelible marker or by affixing a label. If possible, all labeling will be located in the top 1-foot of the tube. The information on the tube includes the project number, project name, date of sampling, boring number, sample number, zone of sampling and any other information the geologist judges to be is pertinent. In addition, the tube is marked TOP and BOTTOM so that the orientation of the soil sample is known. The samples will be shipped to the laboratory by overnight courier.

2.4.3.3.3 HSA Monitoring Well Installation

Based on the current understanding of site hydrogeologic conditions, the following monitor well installation program is proposed. Fifteen (15) wells will be installed in the perched aquifer zone (i.e., if it is present), Fifteen (15) wells will be installed in the upper alluvial aquifer zone, and four (4) wells will be installed in the lower alluvial aquifer zone. The estimated depths for the proposed monitoring wells are illustrated on Figure 8. The proposed monitoring well locations are presented on Figures 5 and 6. These locations are approximate and may be revised based on conditions encountered in the field.

Information on the geology in the vicinity of the site will be collected as these wells are installed and will continually be evaluated in the field. If hydrogeologic conditions are judged to be different than the current understanding, monitoring well locations and depths will be adjusted accordingly.

Appropriate construction permits will be obtained and utilities will be located prior to construction of monitoring wells. The proposed monitoring wells will be installed using the hollow stem auger (HSA) drilling technique. Hollow-stem augers are a type of powered auger used primarily to advance the borehole when soil sampling is required. The hollow-stem auger consists of (1) a section of seamless steel tube with a spiral flight to which are attached a finger-type cutter head at the bottom and an adapter cap at the top, and (2) a center drill stem composed of drill rods to which are attached a center plug with a drag bit at the bottom and an adapter at the top. The adapters at the top of the drill stem and auger flight are designed to allow the auger to advance with the plug in place. As the hole is drilled, additional lengths of hollow-stem flights and center stem are added. The center stem and plug may be removed at any time during the drilling to permit disturbed, undisturbed, or core sampling below the bottom of the cutter head by using the hollow-stem flights as casing. This process also permits the use of augering in loose deposits below the water table. Where this technique is used in unconsolidated material below the water table, fluids of known chemical quality may be used to control ground-water inflow. Undisturbed samples taken in this manner may be more useful than those taken from a cased hole, since the disturbance caused by advancing the auger is much less than that caused by driving the casing.

2.4.3.3.3.1 *Perched Aquifer Zone Wells*

4-1/4-inch ID hollow-stem augers will be used to collect split-spoon soil samples to the bottom of the perched zone. A 2-inch diameter PVC monitoring well will be installed inside of the 4-1/4-inch ID hollow stem augers as discussed in Section 2.4.3.3.3.3.

2.4.3.3.3.2 Upper and Lower Alluvial Aquifer Zone Wells

Initially, 4-1/4-inch ID hollow-stem augers will be used to collect split-spoon soil samples at least five feet into the aquitard unit separating the perched aquifer zone from the alluvial aquifer zone. The borehole will then be reamed out using 12-1/4-inch ID hollow stem augers, which will create an 18-inch diameter borehole. Ten-inch diameter steel casing will then be set inside of the 12-1/4-inch ID hollow-stem augers in order to separate the perched aquifer zone from the alluvial aquifer zone. The casing will be grouted in place with bentonite/cement slurry using a tremmie pipe as the hollow-stem augers are removed. The borehole will then be advanced using 4-1/4-inch ID hollow-stem augers inside of the 10-inch diameter steel casing through the aquitard and approximately 10 feet into the upper alluvial aquifer zone. A 2-inch diameter PVC monitoring well will be installed inside of the 4-1/4-inch ID hollow stem augers as discussed in Section 2.4.3.3.3.3. The screen zone of the upper alluvial aquifer zone monitoring well will extend at least up to the interface between the aquitard and the upper alluvial aquifer zone.

The borehole for the lower alluvial aquifer zone monitoring well will be advanced in the same manner as the upper alluvial aquifer and the steel casing will also be installed at least five feet into the aquitard unit separating the perched aquifer zone from the alluvial aquifer zone. If significant contamination is observed in the upper alluvial aquifer, then the steel casing for the lower alluvial aquifer will extend into the alluvial aquifer to a depth that is beyond the significant contamination, but not beyond the depth of the top of the screen for the lower alluvial aquifer well. The screen zone of the lower alluvial aquifer well will be set on the alluvial aquifer zone/bedrock aquifer zone interface and will extend 10-feet up into the alluvial aquifer zone.

2.4.3.3.3.3 Monitoring Well Construction

The monitor wells will be constructed of 2-inch diameter PVC schedule 40 casing and 10-slot PVC schedule 40 screen. Stainless steel well casing and screen may be used instead of PVC in the event that free product is encountered during drilling. The gravel pack will extend at least two feet above the screen. At least two feet of bentonite pellets will be added on top of the gravel pack to prevent the slurry from running into sand. The bentonite pellets added to the top of the gravel pack will be allowed to hydrate and seal before the bentonite/grout slurry is added. The granular bentonite and cement slurry will be pumped through a tremmie pipe from the top of the bentonite pellets, extending all the way to the ground surface.

Depending on the location, either heavy duty flush-mount protective steel covers or aluminum “stick-up” protective casings with cap and lock will be placed into the ground and sealed with cement and sand. A cement pad will be constructed to slope away from the well, to avoid any seepage from the surface. All the installed monitoring wells will have identical keyed locks. The well depth and number will be marked on the well casing. The installed monitoring wells will be developed using techniques described in Appendix E, until the water is free of sediment to the extent possible.

2.4.3.4 Hillside Soil Gas Sampling

Up to 30 soil gas samples will be collected across the hillside area to further delineate the potential presence of subsurface materials containing organic constituents. Soil gas sampling locations will be determined in the field. They will be concentrated in the vicinity of the north and south “tar seep” areas. Samples will also be collected in the open field and wooded areas to obtain full coverage across the hillside area.

Sample collection will consist of installing a ½-inch diameter solid probe into the ground surface in order to create a pilot hole up to 3-feet in depth at each sampling location. The solid probe is then removed and a second sampling probe of similar diameter with a perforated end is inserted into the pilot hole. The annulus at the ground surface around the sampling probe is sealed with a rubber gasket and a proprietary sampling device is used to pull subsurface air into a pre-purged cylinder. The subsurface air in the cylinder is then purged into a pre-evacuated 40 ml. sample vial. All samples will be collected and analyzed for VOCs and SVOCs at Microseeps, Inc. laboratory.

The results of the hillside soil gas samples will be used to guide the location of hillside soil borings, which are intended to define the vertical and horizontal extent of the “tar seeps”.

2.4.3.5 Hillside Geoprobe Soil Borings

Up to 20 geoprobe soil borings will be advanced in the hillside area (Figure 5) to investigate the potential presence of “tar” beneath the subsurface and to characterize the depth and type of fill material. These soil borings will be used to confirm the results of the soil gas sampling task and placement of these borings will be determined in the field. Continuous soil cores will be collected using the Geoprobe macrocore sampler.

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The acetate Macrocore sample liners will be removed from the 4-foot barrel sampler upon retrieval from the borehole. The acetate core will be split down the middle and the entire core will be divided in half using a stainless steel knife. The entire core interval will be field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID) in accordance with the Standard Operating Procedure presented in Appendix E. Organic vapor readings will be used as a guide to determine intervals to be sampled for laboratory analytical testing. The core sample will be classified by the field geologist for gross composition, texture, color, relative degree of saturation, and other observable characteristics, at a minimum, in accordance with the Uniform Soil Classification System ASTM Method D-2487 (ASTM, 1991d).

The soil description will be recorded on a Sample/Core Log (Appendix F). Each boring will be abandoned by filling the annulus with hydrated bentonite pellets. No soil samples from the geoprobe sampling will be submitted for laboratory analysis. If difficulty is encountered using the geoprobe technique (e.g., refusal), a hollow-stem auger drilling rig may be used to complete the geoprobe soil boring task.

2.4.3.6 Hillside "Tar" Seep Area Physical Samples

Four shelly tube samples and 4 split-spoon grab samples will be collected in the vicinity of the north and south "tar seep" areas for geotechnical analysis to be used for potential stability and/or treatability analysis. These samples will be collected with a hollow-stem auger rig during the Hillside Monitoring Well installation task. The locations and depth of these samples will be determined in the field based on observations noted during the geoprobe soil boring program.

The procedures for collecting a shelly tube sample are described in detail in Section 2.4.3.3.2.1 entitled shelly tube sampling. Each shelly tube sample will be analyzed for falling head permeability and strength as detailed in Table 11. Split-spoon soil samples will be analyzed for:

- Unit weight;
- Moisture content;
- Soil classification;
- Atterberg limits; and,
- Particle size.

2.4.3.7 Hillside Hollow-Stem Auger Borings

Six (6) hollow-stem auger borings will be advanced at the approximate locations illustrated on Figure 5 to determine the depth of waste and the nature of fill material across the hillside area. Continuous split-spoon samples will be collected (ASTM 1586), driven by a 140 lb. Hammer, falling 30-inches. The split-spoon sampler will be 24-inches long, with a flap valve or basket type retainer for positive recovery of the sample. The split-spoon will be opened and the soil core will be divided in half using a stainless steel knife. The entire core interval will be field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID) in accordance with the Standard Operating Procedure presented in Appendix E. Organic vapor readings will be used as a guide to determine intervals to be sampled for laboratory analytical testing. The core sample will be classified by the field geologist for gross composition, texture, color, relative degree of saturation, and other observable characteristics, at a minimum, in accordance with the Uniform Soil Classification System ASTM Method D-2487 (ASTM, 1991d). The soil description will be recorded on a Sample/Core Log (Appendix F). Each boring will be abandoned by filling the annulus with cement/bentonite slurry.

2.4.3.8 Hillside Monitoring Wells

Five two-inch diameter, PVC groundwater monitoring wells will be installed in the uppermost water-bearing zone encountered in the vicinity of the Hillside Area at locations illustrated on Figure 5.

4-1/4-inch ID hollow-stem augers will be used to collect split-spoon soil samples until the uppermost water-bearing zone is encountered. Continuous split-spoon samples will be collected (ASTM 1586), driven by a 140 lb. Hammer, falling 30-inches. The split-spoon sampler will be 24-inches long, with a flap valve or basket type retainer for positive recovery of the sample. The split-spoon will be opened and the soil core will be divided in half using a stainless steel knife. The entire core interval will be field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID) in accordance with the Standard Operating Procedure presented in Appendix E. The core sample will be classified by the field geologist for gross composition, texture, color, relative degree of saturation, and other observable characteristics, at a minimum, in accordance with the Uniform Soil Classification System ASTM Method D-2487 (ASTM, 1991d).

The monitor wells, which will be installed inside the 4-1/4-inch ID hollow stem augers, will be constructed of 2-inch diameter PVC schedule 40 casing and 10-slot PVC schedule 40 screen. The gravel pack will extend at least two feet above the screen. At least two feet of bentonite pellets will be added on top of the gravel pack to prevent the slurry from running into sand. The bentonite pellets added to the top of the gravel pack will be allowed to hydrate and seal before the bentonite/grout slurry is added. The granular bentonite and cement slurry will be pumped through a tremmie pipe from the top of the bentonite pellets, extending all the way to the ground surface.

Heavy duty aluminum “stick-up” protective casings with cap and lock will be placed into the ground and sealed with cement and sand. A cement pad will be constructed to slope away from the well, to avoid any seepage from the surface. All the installed monitoring wells will have identical keyed locks. The well depth and number will be marked on the well casing. The installed monitoring wells will be developed using techniques described in Appendix E, until the water is free of sediment to the extent possible.

2.4.3.9 Sample “Tar” Seeps

Two samples, one from the north “tar seep” area and one from the south “tar seep” area will be collected and analyzed for modified TCL, and hazardous characteristics as presented in Section 1.8.2.14. In addition, one sample from the “tar seep” along the hillside adjacent to Mahan’s Run in the vicinity of Sector A will be collected and analyzed for modified TCL constituents and hazardous characteristics as presented in Section 1.8.2.14. Each sample will be collected using a stainless steel spoon and bowl.

2.4.3.10 Survey Wells and Mahan’s Run

Following the installation of the monitoring wells, each well will be surveyed for horizontal and vertical control. At each location, the elevation of ground surface, inner casing and outer casing will be surveyed. The datum to be used will be mean sea level, which will be taken from an on-site benchmark, to be identified by WPSC. A West Virginia licensed surveyor will perform the survey. The horizontal plane survey accuracy should be +/- 1-foot. The vertical plane survey should be accurate to +/- 0.01-foot. In addition, several existing wells will be resurveyed and compared to previous survey efforts for accuracy and precision.

Up to three locations along Mahan's Run will also be surveyed for vertical and horizontal control to aid in the development of a groundwater flow map. The three locations along Mahan's Run will be established during the surface water/sediment sampling task.

2.4.3.11 Water Level Measurements

Water level measurements will be collected several times in each well, as appropriate during the field investigation. At a minimum, one full round of water-level measurements will be collected from each of the existing and newly installed wells (approx. 81) across the site. Water level measurements will be used to develop potentiometric contour maps and to verify the direction of groundwater flow. Water levels will be measured and recorded as follows:

- Water level measurements will be collected from all wells within a short time period to minimize temporal variations;
- Water level measurements will be determined with an electronic water level indicator to the nearest 0.01 foot and will be converted to a common datum (elevation above MSL) from the known surveyed elevation point for each well;
- The measured water levels will be recorded in the field logbook and/or water level form; and,
- The water level indicator probe and cable will be decontaminated after each measurement.

Each well will be checked for the presence of separate phase product. If a nonaqueous phase liquid is noted visually during soil boring installation, monitoring well installation, well development or during water-level measurements, an electronic hydrocarbon interface probe will be used to measure the separate phase thickness. Water level monitoring procedures are described in SOP No. 22 in Appendix E.

2.4.3.12 Well Evaluation/Development

The groundwater sampling program will include the sampling of existing wells that in some cases have been sampled for several years. The condition and integrity of the existing wells is unknown. Therefore a survey of the existing wells will be performed to determine the condition and integrity of the existing wells. A monitoring well inspection form will be completed for each well (Appendix F). Those wells that are determined to be in satisfactory condition will then be developed in order to ensure that

representative groundwater samples can be obtained during the groundwater sampling event(s). The following mechanical methods may be used, as necessary, to develop each well:

- Submersible pump;
- Large diameter PVC bailer
- Surge block; and/or
- Hand pump.

Groundwater will be removed from each well using one or a combination of the withdrawal techniques listed above until the water is clear and sediment free, to the extent practicable. During development, pH, specific conductance and turbidity will be monitored and used as a gauge for when development is complete.

2.4.3.13 Surface Soil Sampling

A total of 46 surface soil samples will be collected using geoprobe and hollow-stem augers techniques as described in sections 2.4.3.2 and 2.4.3.3 presented above. Surface soil samples will also be collected at three (3) additional locations in Sector F and two (2) additional locations in Sector G using hand-auger techniques to characterize surface soil quality in these areas. Background surface soil samples will be collected using hand-auger techniques at five (5) locations in the Hillside Area (Sector H) at locations illustrated on Figure 5.

All surface soil samples will be collected from the 0- to 1-foot depth. Samples will be field screened for volatile organic compounds (VOCs) using a photo-ionization detector (PID) in accordance with the Standard Operating Procedure presented in Appendix E. Organic vapor readings will be used as a guide to determine intervals to be sampled for laboratory analytical testing. The core sample will be classified by the field geologist for gross composition, texture, color, relative degree of saturation, and other observable characteristics, at a minimum, in accordance with the Uniform Soil Classification System ASTM Method D-2487 (ASTM, 1991d). The soil description will be recorded on a Sample/Core Log (Appendix F). Each boring will be abandoned by filling the annulus with bentonite pellets.

All surface soil samples will be submitted for modified TCL constituents. Sample containers, volumes and preservation methods are specified in Table 10.

2.4.3.14 Groundwater Sampling

A minimum of two (2) groundwater sampling events will ultimately be required to characterize water quality conditions at the facility. Experience has demonstrated that temporal groundwater quality conditions can vary significantly. The temporal variability must be accounted for since corrective action strategies will require an understanding of worst-case groundwater quality conditions that occur in a given year. This specifically relates to the assessment of risk and the adequate design of remedial methodologies, should they be warranted.

Initially a comprehensive groundwater sampling event will be performed which will include new and existing monitoring wells that are illustrated on Figures 5 and 6. A total of 60 locations will be sampled as follows:

- Sector B – 19 new wells, RW-1 and RW-2
- Sector C – 8 new wells, R-210 and R-310
- Sector D – 7 new wells, VA-1, VA-1A, VP-2 and VA-2
- Sector E – RSA-1, thru RSA-3, PDA-1 thru PDA-4
- Sector F – VA-3, P-1, TDI-D, TDI-S and TDI-P
- Sector G – MW-2A
- Sector H – 5 new wells

Low-flow sampling techniques will be used to collect a representative groundwater sample from each well as described in Appendix E. Groundwater samples will be collected within the screened interval in each well so that the sample is representative of formation water. Groundwater samples will be submitted for a modified TCL constituents and biogeochemical parameters. If the turbidity of the water withdrawn from the well during sampling exceeds 5 NTU, a sample will be collected for dissolved metals (field filtered) in addition to a sample for total metals (unfiltered). Sample containers, volumes, and preservation methods are specified in Table 10. Water samples will be collected and transferred to appropriate sample containers in the following order:

1. VOCs;
2. SVOCs;
3. PAHs;

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4. Total metals;
5. Dissolved metals
6. Cyanide and ammonia; and,
7. Biogeochemical parameters.

For samples to be analyzed for dissolved metals, filtration will be conducted in the field either inline or immediately after collection using a 0.45-micron membrane filter following the procedures defined in Appendix E. After the sample is filtered, it will be preserved following the requirements identified in Table 10. Samples will be stored, packaged, and shipped to an appropriate laboratory as described in Appendix E.

Prior to sample collection, field water quality parameters (pH, temperature, conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity) will be measured and recorded. Water odor, clarity, and color will also be described. All purge water will be containerized and transported to Hatcher's Pad area for discharge into the facility wastewater treatment system.

Each well will be gauged prior to sampling for the presence/absence of free product (i.e., LNAPL and DNAPL). A groundwater sample will not be collected from those wells containing separate phase.

2.4.3.15 Surface Water/Sediment Sampling (Mahan's Run)

One round of surface water/sediment sampling will be performed. Surface water/sediment sampling will provide quantitative and qualitative data concerning the degree, nature and extent of constituents in Mahan's Run.

Background or upgradient sampling locations regardless of the media should be in a "clean" area so that they may provide representative background quality in the media of concern. Samples should be collected in the same environmental setting as the downgradient sampling locations, to the extent practicable, unless the media of concern changes rapidly across the site. For example, an upgradient sediment sample should not be collected in sandy soil types if the downgradient samples are collected from clay soil types. Location of the sampling points should also consider surface runoff, agricultural and industrial activities that may be affecting the quality of the upgradient sampling locations. As a result, the constituent concentration measured at each of

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these upgradient sampling locations will represent “background” levels, to the extent possible. Sediment samples will be collected in areas of deposition or accumulation of fine-grained sediments, to the extent possible.

The objective of the surface water/sediment sampling task is to determine if any alteration of Mahan’s Run has occurred as a result of constituents potentially released from the Hillside Area. Thirteen (13) surface water/sediment samples will be collected and analyzed for a modified TCL (Tables 6 through 11). Additional laboratory analysis will be performed on surface water and sediment samples. Additional laboratory analysis for surface water samples will include:

- Total suspended solids (TSS);
- Total dissolved solids (TDS);
- Biological oxygen demand (BOD);
- Chemical oxygen demand (COD);
- Total Organic Carbon (TOC);
- Alkalinity; and,
- Hardness.

Additional laboratory analysis for sediment samples will include:

- TOC;
- Grain size;
- Percent Moisture; and,
- Percent Solids.

At each sampling location the following information will be recorded:

- Sample location, identification number, date and time;
- Temperature, Dissolved Oxygen, Specific Conductance, Redox, pH and turbidity;
- Depth of stream at point of sampling;
- Weather conditions;

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- Physical characteristics (odor, color, multiphase, layering, precipitates);
- Stream characteristics (fast running versus stagnant); and,
- Evidence of stresses vegetation or wildlife.

Surface water samples will be collected from Mahan's Run by filling a polyethylene tri-pour beaker from the stream. Surface water will then be transferred to the appropriate sample containers (Table 11). The downstream sample will be collected first and remaining samples collected at progressively upstream locations. Surface water samples will be collected before sediments are disturbed. Surface water sample information will be recorded on the sample log sheet. The samples will then be stored, packaged, and shipped to an appropriate laboratory as described in Appendix E.

Sediment sampling of Mahan's Run will occur in conjunction with surface water sample collection. During sediment sampling the following procedures will be employed:

- The sampling team will begin by collecting a sample from the furthest downstream location and work their way upstream;
- A two-inch diameter sediment core sampler containing a clean inner removable aluminum sleeve will be uniformly advanced into the stream-bed approximately four- to six-inches;
- The core sampler will carefully be removed from the stream and the sample will be ejected from the cylinder;
- The volatile organics sample container will be filled with material directly from the sampler; and,
- The remaining sample will be placed in a large stainless steel bowl, thoroughly mixed with a stainless steel trowel or spoon, and placed in the remaining sample containers.

The samples will then be stored, packaged, and shipped to an appropriate laboratory as described in Appendix E.

2.4.3.16 Slug Testing

Nine slug tests will be performed: three in perched aquifer zone wells, three in upper alluvial aquifer wells and three in lower alluvial aquifer wells. These tests serve an important function in determining the interconnection of aquifer zones and provide design information for potential remedial scenarios, should the RFI results demonstrate that corrective is necessary.

The wells to be tested will be selected after well installation is complete and will be based on observations noted during soil boring advancement and well installation. The objective will be to select three wells within a given aquifer zone that will provide a representative cross-section of conditions across the site within that given zone.

Both slug in and slug out tests will be performed. A single channel transducer will be used to record background water level measurements and changes prior to testing. The slug test procedure will involve rapidly lowering a solid core to displace water from the well. The resultant water-level rise or recovery will be monitored at logarithmic intervals using a calibrated in-situ pressure transducer and Hermit Data-logger until recovery is complete. The slug will then be rapidly removed and again the water level drop or recovery will be monitored at logarithmic intervals using a calibrated in-situ pressure transducer and Hermit Data-logger until recovery is complete. The data will be interpreted using Aqtesolvtm, which is the industry-accepted software standard for slug test analysis.

2.4.3.17 Environmental Site Assessment

Phase I Environmental Site Assessments will be completed for the following areas of concern:

- H-8 Provenzano Trucking,
- H-10 PGT Trucking; and,
- H-11 Murphys Consolidated Industries

The Phase I Environmental Site Assessments will be conducted in accordance with American Society of Testing and Materials (ASTM) Guidance Document E1527-2000 for conducting Phase I Environmental Site Assessments, and will include the following general tasks.

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- An inspection of the grounds and structures and an evaluation of the surrounding properties will be performed to identify areas of potential environmental impairment. The scope of this section will include but not be limited to: site history and former usage, underground and aboveground storage tanks, suspect PCB and asbestos containing materials, chemical, medical, and regulated waste disposal.
- Interviews with site representatives or others familiar with past and present activities, which will include a review of an environmental questionnaire.
- Historical documents will be reviewed to obtain information on historical property use. The documents reviewed will include, but not be limited to, the following: aerial photographs, Sanborn™ Fire Insurance Maps (if available), geotechnical map information, and available environmental quality data for the site.
- A review of the available federal, state, and local documents relevant to the environmental quality and subsurface conditions in the area will be conducted. This will include: spill logs, regulatory records, publications, and geotechnical information. This review will encompass a 1 mile radius of the property and include the following databases: National Priorities List (NPL), Facility Index System (FINDS), Comprehensive Environmental Response and Compensation Liability Information System (CERCLIS), Resource Conservation and Recovery Act (RCRA) notifiers, Emergency Response Notification System (ERNS), State Inactive Hazardous Waste Sites, and State Registered and Leaking Underground Storage Tank Facilities.
- Two geoprobe soil borings will be advanced at the Murphy Consolidated Industries leased property. The location of these borings will be based on the results of the Phase I environmental assessment activities described above. Three soil samples will be collected at each boring location (i.e., near surface, mid zone and just above the uppermost water-bearing zone). In addition, one (1) groundwater samples will be collected at each geoprobe location.
- Four (4) geoprobe soil borings will be advanced at the Provenzano Trucking Company leased property. The location of these borings will be based on the results of the Phase I environmental assessment activities described above. Three soil samples will be collected at each boring location (i.e., near surface, mid zone and just above the uppermost water-bearing zone). In addition, one (1) groundwater samples will be collected at each geoprobe location.

The scope of work in this Assessment will not include:

- Sampling or analysis of waste or air.
- Sampling of potential asbestos containing material.
- Chain-of-title information to evaluate previous land usage for a period of up to 50 years past.

The findings will be summarized in a written section of the RFI report. Recommendations will be provided, which will include additional investigations, as necessary.

2.4.4 Field Decontamination Procedures

This section provides decontamination procedures for most drilling and sampling equipment. Any equipment requiring special decontamination will be noted under the appropriate field tasks.

2.4.4.1 Drilling Rig and Related Equipment

The drilling rig and related equipment will be decontaminated initially before drilling, between borehole locations, and after the final borehole is completed. Equipment to be decontaminated includes the back of the drilling rig, auger flights, drilling rods, drill bits, wrenches and split-spoons. The drilling rig and equipment will be decontaminated by the drilling subcontractor under the supervision of the Field Operations Leader (FOL) or his designee. The specific procedure is as follows:

- Gross contamination (i.e., soil, mud, etc.) will be removed by steam cleaning with potable water and nonphosphate detergent. Any equipment with loose paint chips or that is badly rusted will be scrubbed with a wire brush.
- Once all visible contaminants are removed, a final rinse by steam cleaning with potable water will be performed.
- Duration of the decontamination process will be determined by the FOL.
- Depending on the quantity and quality of “tar” materials encountered at the site, it may be necessary to introduce other decon agents such as methanol to remove coal tar from the equipment.

2.4.4.2 Sampling Equipment

Items such as split-spoon samplers, stainless steel bowls and spoons, pump, or bailers, which come into direct contact with a sample for chemical analysis must be decontaminated utilizing the following procedure:

- Scrub with a brush using tap water and a low phosphate detergent;
- Rinse with tap water;
- Rinse with methanol, if necessary to remove tar accumulation;
- Rinse with deionized water;
- Air dry; and,
- Wrap in aluminum foil (shiny side out) for transport.

2.4.5 Field Quality Control/ Quality Assurance Samples

2.4.5.1 Field Duplicate Samples

Field duplicates will be collected from locations believed to be moderately contaminated at a frequency of at least 5 percent (i.e., 1 duplicate per 20 primary samples) of the total number of environmental samples. Duplicate soil samples will be collected by obtaining a second sample at the same depth. The upper portion of the soil core will be the primary sample, and the lower portion will be the duplicate sample. Groundwater duplicate samples will be collected by filling the primary sample and duplicate sample containers consecutively by parameter.

2.4.5.2 Trip Blanks

A trip blank will be submitted at a frequency of one per sample shipment sent to the laboratory containing aqueous samples for VOCs. The trip blank is shipped to and from the field with the sample containers. It is not opened in the field and, therefore, provides a test for contamination from sample preservation, site conditions, and transport, as well as sample storage, preparation and analysis. Trip blanks will be analyzed for the same parameters as the primary samples they accompany.

2.4.5.3 Equipment Blanks

Equipment blanks will be collected at a rate of one per sample matrix per equipment type per day or one per 20 environmental samples, whichever results in fewer samples (USEPA, 1987). An equipment blank will be not collected if disposable sampling equipment is used to collect the sample. Equipment blanks will be collected by pouring final rinse water over the soil or groundwater sampling equipment and collecting the water in sample jars. Equipment blanks will be analyzed for the same parameters as the associated primary samples.

2.4.5.4 Quality Assurance Split Samples

QA split samples are separate field duplicate samples submitted to an independent QA laboratory upon request by the USEPA. QA split samples will be analyzed for the same parameters as the corresponding field samples. Significant disagreements between the QA sample results and the primary sample results may require an investigation of the suspect data. If investigation reveals errors in analytical procedures by the contract laboratory, then re-sampling may be required.

2.4.6 Field Sample Management

2.4.6.1 Sample Identification

A sample numbering system has been established and will be implemented to identify both environmental and quality control samples collected and submitted for analysis. The purpose of the numbering system is to assist in the tracking of samples and to facilitate retrieval of analytical results.

2.4.6.1.1 Environmental Samples

Each sample will be assigned a unique sample identification number using the following format:

- [Sample Type & Sector]-[Sequential Sample Number]-[Matrix]-[Sample Depth]

Codes for common sample types are as follows:

- Sample Type –
 - SD - Sediment
 - SW - Surface Water

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- MW - Monitoring Well
- SB - Soil Boring
- GP - Geoprobe
- SP - Seep
- WW - Wastewater
- Sector – A through H
- Matrix –
 - W - Water
 - S - Solid
- Depth Interval – 0.1, 0.2, etc.

The Location code will identify the Sector with which the sample is associated, and sample point identification. The matrix will identify whether the sample is a water (W) or a solid (S) sample. The depth interval will be used for soil samples only and will be posted in feet and will be accurate to the 0.1 ft. An example sample identification of a groundwater sample collected from MW4 in Sector B would be identified as such:

- MWB4W

2.4.6.1.2 Duplicates

Duplicate samples will be submitted to the laboratory blind (i.e., the laboratory will not know they are a duplicate samples). Duplicate samples will be given a false identification number in the field following the sample identification formula. The actual location of the duplicate sample will be recorded in the field notebook and/or field sampling log at the time of collection and provided to the Project Manager. Field duplicate analytical results will be reported with the primary environmental sample results.

2.4.6.1.3 Field Blanks

Field blanks will be identified using the following format:

[Blank Type & Date]-[Sequential Sample Number/Cooler Number]

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Codes for field blanks are as follows:

- Rinse Blanks RB
- Trip Blanks TP
- Field Blanks FB

An example of the first equipment blank sample identification that was collected on April 3, 1999, is:

- RB040399-1

An example of a trip blank associated with sample shipping container number 3 sent the same day is:

- TB040399-3

2.4.6.2 Sample Containment and Preservation

Specifications for sample container size and type, and preservation protocols are provided in Table 10. Water samples shall be slowly poured into the appropriate sample containers for laboratory chemical analysis. Both water and soil containers shall be filled to the neck of the container. Water samples for VOCs shall be filled to overflowing and capped with zero head space in the sample vials. The Contract Laboratory will supply all sample containers, complete with appropriate preservatives.

2.4.6.3 Sample Packaging and Shipment

All solid and water samples will be transferred to the corresponding laboratories by courier or FedEx. Solid and water samples will be stored and shipped in separate coolers. The following sample packaging and shipment standard procedure will be followed.

- Place each individual solid sample or water sample container into individual sealable plastic bags.
- Place samples designated for analysis into coolers. If there are samples going to separate laboratories, they need to be placed into separate coolers. Only one sample media type may be placed in each cooler (i.e., soil and water go in separate coolers).

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- Include one trip blank in each cooler containing water samples to be analyzed for VOCs.
- Empty spaces in the coolers will be filled with an appropriate packing material (such as bubble wrap) to protect sample containers from breakage.
- Repackage ice in 5-quart sealable plastic bags and place in coolers. Ice is to be double bagged. Place enough ice in each cooler to chill and maintain the cooler to 4°C during shipment.
- A chain-of-custody form will be completed and placed in a sealable bag. The chain-of-custody form will then be attached to the inside of the ice chest lid with strapping tape.
- Seal the ice chest and drain plug shut with strapping tape.
- Affix custody seal to cooler.
- Affix airbill, as well as laboratory and return addresses, to the outside of the ice chests.

In order to avoid exceeding holding times, all samples will be shipped at the end of each day of sampling, via courier or FedEx to the appropriate analytical or geotechnical laboratory,

2.4.6.4 Chain of Custody

The following sample custody procedures are to ensure that the following objectives are met:

- Each sample is identified uniquely and correctly;
- Each sample is traceable to its source/point of origin;
- Sample representativeness is preserved;
- Sample alteration, such as by preservation, filtration, is documented; and,
- A record of sample integrity is established and maintained throughout the custody process.

Sample custody is to be maintained and documented in the field, during shipment, and at the contract laboratory. Custody procedures are to be implemented such that accurate and complete records of sample collection, transfer of samples between

personnel, sample shipment, and receipt by the laboratory are generated and retained. Records concerning the cleaning of sample containers, container shipment to the site, and security of empty containers at the site are to be retained.

2.4.6.4.1 Field Custody

Custody is to be maintained during sample collection, preservation, packaging, and delivery to shipping agent. Field custody procedures are to provide for generation and control of sample custody records. Custody records are to be generated in the field at the time of sample collection. A person is in custody of a sample if the sample is in that person's physical possession, in view after being in that person's physical possession, placed in a locked repository by that person, or placed in a secure restricted area by that person. Samples collected from a site are to be identified with a sample label and an entry on a chain-of-custody record.

The original custody record is to be placed in a sealable plastic bag and taped to the lid of the secured shipping container. A copy of the record will be retained by the Field Coordinator until confirmation of receipt of the coolers by the appropriate laboratories. Upon said confirmation of receipt, the Field Coordinator's records are to be submitted to the Task Manager for inclusion into the project files.

Two custody seals are to be affixed over opposite edges of each cooler such that at least one seal is broken when the cooler is opened. Each seal is to be initialed/dated by the person relinquishing custody for shipment. These initials and date are to match the relinquishing signature/date on the custody form.

The air bill numbers are to be entered into the appropriate custody forms prior to packaging. The Field Coordinator is responsible for ensuring that these forms are completed as required by the carrier, including indicating "Saturday Delivery" as warranted by the sampling schedule.

2.4.6.4.2 Shipment Custody

Custody is to be maintained during time spent under the control of and tracking by the carrier. To the extent practical, only carriers that provide tracking of each package (e.g., federal express preferred) are to be used. The form is to be packaged in a plastic sealable bag, within the sample cooler prior to affixing the custody seal.

2.4.6.4.3 Contract Laboratory Custody

Custody in the laboratory is addressed in the Laboratory Quality Management Plant (LQMP) found in Appendix D. Upon sample receipt at the laboratory, the laboratory sample custodian shall assess the condition of the cooler and field samples and document his/her findings on a Cooler Receipt Checklist. Coolers and custody seals are to be inspected, upon receipt, for signs of damage or tampering. Inconsistencies between custody records and sample shipment and coolers arriving with broken seals are to be reported promptly by the laboratory to the Project Manager.

2.5 Laboratory Analytical Requirements

2.5.1 Analytical Parameters

This section specifies the analytical methods that will be used when analyzing project samples. USEPA Test Methods for Evaluation of Solid Waste (SW-846) (USEPA, 1995) will be used for chemical analysis of samples for a modified version of the Target Compound List (TCL) specified in EPA SOW OLM03.2 as discussed below. Samples will be analyzed for biogeochemical parameters using a methods developed by Microseeps®. Samples collected to test physical characteristics will be tested using American Society of Testing and Materials Methods (ASTM, 1991a; 1991b). The analytical program and the selected chemical parameters of concern are outlined in Tables 6 and 11. Preparation and analytical methods are defined in Table 11.

Parameters and/or constituents to be analyzed will vary depending on the media and location of a given sample, as presented in Tables 6 and 7. Samples will be analyzed for a modified TCL of constituents. The TCL has been modified to eliminate the analysis of pesticides/PCBs, since these constituents are not reasonably expected to be present in the media at the site. In addition, based on discussions with USEPA, the following constituents have been added to the TCL:

- Acetophenone;
- Aniline;
- Acetonitrile;
- Pyridine;
- Bis(2-chloroisopropyl) ether;
- Butyl benzyl phthalate;

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- N-nitroso-di-n-propylamine;
- Cyanide;
- Ammonia; and
- Sulfide.

All groundwater samples will also be analyzed for a list of biogeochemical parameters as presented below to evaluate the biodegradation processes that are likely occurring. Four surface and/or subsurface soil samples from the Hillside area will be analyzed for a list of geotechnical parameters as presented below. In addition to the modified TCL, surface water samples will be analyzed for a list of indicator parameters presented below. In addition to the modified TCL, sediment samples will be analyzed for total organic carbon and physical parameters presented below.

The following parameter groups and or constituents will be analyzed for depending on the media and sampling location:

MODIFIED TARGET COMPOUND LIST OF CONSTITUENTS

- VOCs – SW-846
 - Surface and Subsurface Soil
 - Groundwater
 - Surface Water
 - Sediment
 - “Tar” Seeps
- SVOCs – SW-846
 - Surface and Subsurface Soil
 - Groundwater
 - Surface Water
 - Sediment
 - “Tar” Seeps
- Metals – SW-846
 - Surface and Subsurface Soil
 - Groundwater (total and dissolved)
 - Surface Water

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- Sediment
- "Tar" Seeps
- Inorganics – SW-846 cyanide, ammonia
 - Surface and Subsurface Soil
 - Groundwater
 - Surface Water
 - Sediment
 - "Tar" Seeps

OTHER PARAMETER GROUPS

- Biogeochemical Parameters – Dissolved gases including methane, carbon dioxide, carbon monoxide, nitrogen and oxygen. Constituents in groundwater including chemical oxygen demand, sulfate, sulfide, alkalinity, nitrate, nitrite, ferrous iron, dissolved manganese and dissolved organic carbon.
 - Groundwater
- Geotechnical Parameters – unit weight, moisture content, soil classification, atterberg limits, particle size, permeability, strength, and TCLP.
 - Hillside Surface and/or Subsurface Soil
- Surface Water List (SWL) – total suspended solids, total dissolved solids, biological oxygen demand, chemical oxygen demand, total organic carbon, alkalinity and hardness.
 - Surface Water
- Sediment List (SL) – total organic carbon, grain size, percent moisture and percent solids.
 - Sediment
- Aquifer Physical Properties (AQFPP) – porosity, grain size, moisture content, total organic carbon and bulk density.
 - Split-Spoon sample
 - Shelby tube sample

- Aquitard Physical Properties (AQTPP) – vertical permeability
 - Shelby Tube sample
- Hazardous Characteristics – ignitability, reactivity and corrosiveness
 - “Tar” Seep sample

Constituent Practical Quantitation Limits (PQLs) and Method Detection Limits (MDLs) were compared to screening levels [USEPA Region III Risk-based Concentrations for soil and tap water and Federal Maximum Contaminant Levels (MCLs) for drinking water] and are presented in Appendix G. Soil/sediment PQLs are expressed on a dry weight basis.

Laboratory analytical results will be reported as follows:

- If the result is nondetect, it will be reported as a nondetect and flagged with a U qualifier (organics will be reported as PQL U, inorganic as IDL U).
- Pace will report estimated values (flagged with a J qualifier) to the MDL for organics, to the IDL (Instrument Detection Limit) for metals, or to the threshold limit set for the instrument for organics and inorganics. That limit will be set at or below the MDL.
- If the result is greater than the PQL, the result will be reported without qualifiers.

2.5.2 Laboratory Calibration

Prior to sample analysis, chemical calibration of each target compound must be performed to ensure analytical instrumentation is functioning within the established sensitivity range. The following sections outline the protocols for calibration based on USEPA *Test Methods for the Evaluation of Solid Waste* protocols.

2.5.2.1 Laboratory Solution Validation

Calibration solutions and standards to be used in this program will be prepared and maintained under the normal laboratory standards tracking system. This system

ensures preparation, checking, documentation, storage, and disposal of standards according to specified procedures and schedules appropriate for each analyte of interest.

2.5.2.2 Laboratory Initial Calibration

Initial calibrations must be performed as specified in the analytical method. For organics analysis, the low standard of the curve must be analyzed at a concentration that will verify the reported PQL. For metals analysis, a CRDL standard must be analyzed at the beginning and end of each analytical sequence. Initial calibration is required when the MDL is determined; the instrument is placed into service (other than daily start-up and shut-down); the instrument has not been previously calibrated; or if the instrument fails either daily or continuing calibration. At no time shall any result be reported below the established MDL for organics analysis or below the IDL for metals analysis.

2.5.2.3 Laboratory Daily Calibration

Prior to sample analysis, the calibration of the instruments will be verified to ensure that the instrumental response has not changed from the previous calibration. Daily calibration must be performed for both target compounds and system monitoring compounds at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of the method blank and samples. Daily calibration response must meet the following criteria:

Metals:

- Metals recovery, except mercury, must be within $\pm 10\%$; and
- Mercury recovery must be within $\pm 20\%$

Organics:

- GC/MS methods: The minimum requirements as specified in EPA Method 8270C (Semivolatile analysis) and EPA Method 8260B (volatile analysis) must be followed for the analysis and evaluation of daily and continuing calibrations. See also, the specific laboratory Standard Operating Procedures for the analysis.

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If the daily calibration does not meet the acceptance criteria, the calibration must be re-analyzed. If the response of the second analysis does not meet daily calibration criteria, the system must be taken out of service and maintenance performed to bring it back into calibration. The system shall not be used for the analysis of samples until it has been demonstrated to be back in calibration. If significant changes in the system have been made, then a new initial calibration must be performed prior to the analysis of any samples.

After sample analyses are complete, a continuing calibration standard must be analyzed (if required by the specific EPA method). If the response of the standard does not meet the calibration criteria, then the calibration standard may be re-analyzed once. If the second calibration standard does not meet calibration criteria, then the system must be taken out of service and maintenance performed to bring it back into calibration. The system shall not be used for the analysis of samples until it has been demonstrated to be back in calibration. If significant changes in the system have been made, then a new initial calibration must be performed, and any samples analyzed back to the last acceptable calibration standard must be re-analyzed.

Samples do not require re-analysis if the result for the parameter is non-detect, and the response for the parameter in the continuing calibration is high, but within 40% of the expected value. The sample results are to be reported and documented in the case narrative.

2.5.2.4 Laboratory Continuing Calibration

Continuing calibration will be performed in accordance with USEPA SW-846 protocols and will include the following (USEPA, 1995):

- When inorganic analyses are performed, a blank and a continuing calibration standard should be analyzed after every batch (typically after every 10th or 20th sample. See the laboratory SOP for specific requirements on batch size and acceptance criteria)
- When GC/MS volatile analyses are conducted, a blank and a continuing calibration standard should be analyzed every 12 hours.
- When GC/MS semivolatiles are analyzed, a continuing calibration standard should be analyzed every 12 hours.
- For other organic methods, a blank and a continuing calibration standard should be analyzed every 12 hours.

If a continuing calibration standard does not meet limits of acceptability after two attempts, analysis should stop until such time as the cause of the abnormality can be corrected. Samples analyzed back to the last acceptable calibration standard should be re-analyzed.

Samples do not require re-analysis if the result for the parameter is non-detect, and the response for the parameter in the continuing calibration is high, but within 40% of the expected value. The sample results are to be reported and documented in the case narrative.

2.5.3 Laboratory Documentation and Reporting

This section presents the collection, reduction, and reporting of the data by the laboratory. Data will be reported from the laboratory to CEC in two formats: hard copy and electronic. The formats for each deliverable type and independent data validation procedures are described below.

2.5.3.1 Data Collection, Reduction, and Reporting

The reduction, validation, and reporting of WPSC RFI sample results are described in this section. The intended use of the data and the associated acceptance criteria for data quality will be determined before the data collection effort begins. Reported data will include when appropriate, statements of precision, accuracy, representativeness, completeness, and comparability. Data processing procedures will be documented, reviewed, and revised by the QA Manager, as required to meet USEPA data quality requirements. The laboratory QA Manager will be responsible for data processing at the contract laboratory.

2.5.3.1.1 Collection

Data are initially collected, converted to standard reporting units (i.e., mg/kg for solid media, and $\mu\text{g/L}$ for aqueous media), and recorded in standard formats by the contract laboratory Project Chemist. The Project Chemist conducts preliminary data analyses using a variety of methods and procedures. Because many analytical instruments are microprocessor controlled, some of the requisite analyses can be performed directly in the instrument's operating or outputting mode. Those instruments interfaced to stand-alone computers or microprocessors often permit data analysis programs to be written and modified to produce data formats specifically suited to end user requirements. Data requiring manual recording, integration, and/or analysis may be converted to a more appropriate format prior to subsequent analyses. Through all stages and aspects

of data processing, the data are double-checked for translation or transcription errors and are initialed by both the recorder and the checker. The contract laboratory QA Manager or other designated individual not directly involved in the analysis reviews the data for acceptability.

2.5.3.1.2 Reduction

Data reduction frequently includes computation of analytical results from raw instrument data and summary statistics, including standard errors, confidence intervals, test of hypotheses relative to the parameters, and model validation. For routine analyses performed at the laboratory, sample response data will be entered into the laboratory LIMS system by the analyst.

Data reduction procedures address the reliability of computations and the overall accuracy of the data reduction. The numerical transformation algorithms used for data reduction will be verified against a known problem set to ensure that the reduction methods are correct. The equations and the typical calculation sequence that should be followed to reduce the data to the acceptable format are instrument and method-specific. Where standard methods are modified, data reduction techniques will be described in a report accompanying the data.

2.5.3.1.3 Laboratory Data Reporting

Data reporting procedures for the laboratory are provided in the SW-846 (USEPA, 1995). These procedures yield analytical data and QA/QC summaries. The laboratory's procedures are briefly outlined below:

- Manual Recording: The Laboratory's Standard Operating Procedures describe the QC procedures used for laboratory notebooks and include data worksheets that are routinely used in the reduction of quantitative instrument data to a report format expressed in terms of concentrations. Instrumental data are entered on summary worksheets using microcomputers and appropriate software.
- Automated Recording: Many analytical measurements at the laboratory are automatically recorded and have their own computerized data systems. The laboratory instrument checklists include checks on the operation of these data handlers and internal validity checks are used to flag data resulting from electronic interferences.

- Calculation of Results: Whenever possible, calculations are computerized for efficiency and to avoid human error. The analytical data systems mentioned above calculate results as programmed and provide hard copy in the desired format. In all cases, computerized data are verified for error control, and careful handling of computer storage peripherals is stressed. Tests are built into the programs to trap transcription errors or missing items. The record of the run contains the calculation results and the input data. Analytical results are reduced to the correct number of significant figures for the measurement technique.
- Data Review: Acceptable limits are provided to help the operator identify questionable data and control charts are used whenever possible to show if the procedure is in control. The laboratory's QC Coordinator initiates control charts for instrument performance and specific analytical methods, and reviews routine and specialized QC sample results as they pertain to each project.

2.5.3.2 Laboratory Deliverables

2.5.3.2.1 Data Packages

Full data packages are required from the contract laboratory for 100-percent of samples analyzed by the contract laboratory. These data packages are to be submitted by the contract laboratory to the Project Manager for review. Full data packages are to be prepared as described in the following sections:

2.5.3.2.1.1 Organics Analyses

A full data package for organics analyses is to include a narrative, chain-of-custody documentation, summary of results for environmental samples, summary of QC results, and the raw data. Detailed descriptions of the requirements for each component of an organics data package are provided in the following sections. This information can be provided as laboratory tables from a LIMS or as CLP/CLP-Like Forms.

- Narrative: The narrative is to be written on laboratory letterhead and signed by the laboratory manager. The narrative is to include field sample numbers with the corresponding laboratory sample numbers, parameters analyzed for in each sample and the methodology used (USEPA method numbers or other citation), a statement on the status of samples analyzed with respect to

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holding times (met or exceeded), detailed description of all problems encountered, discussion of possible reasons for out of control QC criteria, and observations regarding any occurrence that may effect sample integrity or data quality.

- Chain-of-Custody Documentation: The data package is to include legible copies of chain-of-custody forms for each sample, and cooler receipt checklists for each cooler. Cooler checklists are to be associated with the corresponding chain-of-custody form. Any internal laboratory tracking document is to be included.
- Summary of Environmental Results: For each environmental sample analysis this summary should include field sample number and corresponding laboratory sample number, sample matrix, date of sample extraction (if applicable), date and time of analysis, identification of the instrument used for analysis, GC column and detector specifications (if applicable), weight or volume of sample used for analysis/extraction, dilution or concentration factor used for the sample extract, percent moisture in the sample, method detection limit or sample quantitation limit, definitions of any data qualifiers used, and analytical results.
- Summary of QC Results: The following QC results are to be presented in summary form. This summary should include the field sample number and corresponding laboratory sample number, sample matrix, date of sample extraction (if applicable), date and time of analysis, identification of the instrument used for analysis, GC column and detector specifications (if applicable), weight or volume of sample used for analysis/extraction, dilution or concentration factor used for the sample extract, percent moisture in the sample, method detection limit or sample quantitation limit, definitions of any data qualifiers used, and analytical results. QC acceptance limits are to be provided with the data. Summaries are to be presented on Contract Laboratory Program (CLP) standard forms. Submission of standard instrument output alone is unacceptable to satisfy this requirement.
 - Initial Calibration: The concentrations of the standards used for analysis and the date and time of analysis. The response factor, percent relative standard deviation (%RSD), and retention time for each analyte (as applicable, GC and GC/MS analyses) are to be included in initial calibration summaries. The start date from which the initial calibration applies.
 - Daily Calibration and Mid-level Standard: The concentration of the calibration standard used for daily calibration and/or the mid-level calibration check is to be reported. The

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response factor, percent difference, and retention time for each analyte are to be reported (GC and GC/MS). Daily calibration information is to be linked to sample analyses by summary or by daily injection or analysis logs.

- Method Blank Analyses: The concentrations of any analytes found in the method blanks are to be reported. The environmental samples and QC analyses associated with each method blank are to be stated.
- Surrogate Standard Recovery: The name and concentration of each surrogate compound added are to be detailed. The percent recovery of each surrogate compound in the samples, method blanks, matrix spike/matrix spike duplicates and other QC analyses are to be summarized with sample numbers such that the information can be linked to sample and QC analyses.
- Matrix Spike/Matrix Spike Duplicates: The sample results, spiked sample results, percent recovery, and RPD with the associated control limits are to be detailed. For laboratory duplicate analyses the RPD between duplicate analyses is to be reported as applicable. For laboratory QC Check and/or LCS analyses the percent recovery and acceptable control limits for each analyte are to be reported. All batch QC information is to be linked to the corresponding sample groups.
- Retention Time Windows (GC, GC/MS): The retention time window for each analyte for both primary and confirmation analyses is to be reported for GC analysis and for the internal standards for GC/MS analysis (See also the sample quantitation reports for additional retention time window information). Retention time windows are to be updated daily or with each analytical sequence per USEPA SW-846.
- Compound Identification (GC, GC/MS): The retention times and the concentrations of each compound detected in environmental and QC samples are to be reported for both primary and confirmation analyses.
- Method Detection Limits: Results of the most current detection limit study are to be provided in the raw data package.
- Injection Record: Injection logs for all instruments used for analysis of project samples are to be provided indicating the date and time of analysis of project samples and the associated laboratory QC samples (e.g., initial calibration, continuing calibration check, method blank, and matrix spikes).

- **Raw Data:** Legible copies of raw data are to be organized systematically on numbered pages. The raw data for compound identification and quantitation are to be sufficient to support the results presented in other sections of the data package. Raw data are to be presented on standard forms and accompanied by the instrument output. Use of CLP standard forms is not necessary; however submission of standard instrument output alone is unacceptable to satisfy the requirements for raw data packages.
 - **GC Analyses:** This section of the data package is to include legible copies of the raw data for environmental samples (arranged in increasing order of field ID, primary and confirmation analyses), instrument calibrations, QC analyses, sample extraction and cleanup logs, instrument analysis logs (injection record) for each instrument used, and GC/MS confirmations if applicable. The raw data for each analysis is to include chromatograms (preferably with target compound, internal standard and surrogate compounds labeled by name) with a quantitation report and/or area print out.
 - **GC/MS Analyses:** This section of the data package is to include legible copies of the raw data for environmental samples (arranged in increasing order of field ID, spectrometer tuning and mass calibration reports, initial and continuing instrument calibrations, QC analyses, sample extraction logs, and instrument analysis logs (injection record) for each instrument used. The raw data for each analysis is to include chromatograms (preferably with target compound, internal standard and surrogate compounds labeled by name) and enhanced spectra of target compounds and/or tentatively identified compounds with the associated best matched spectra. Quantitation reports for each analysis are to be included in the data package.

2.5.3.2.1.2 *Inorganics Analyses*

The full data package for inorganics analyses consists of a case narrative, chain-of-custody documentation, summary of results for environmental samples, summary of QC results, and the raw data. Detailed descriptions of the requirements for each component of an inorganics full data package are provided in the following sections. This information can be provided as laboratory tables from a LIMS or as CLP/CLP-Like Forms.

- **Narrative:** The narrative is to be written on laboratory letterhead and signed by the laboratory manager. The narrative is to include field sample numbers with the corresponding laboratory sample numbers, parameters analyzed for in each sample and the methodology used (USEPA method numbers or other citation), a statement on the status of samples analyzed with respect to holding times (met or exceeded), detailed description of all problems

encountered, discussion of possible reasons for out of control QC criteria, and observations regarding any occurrence that may effect sample integrity or data quality. The narrative is to include sufficient detail such that the process of analysis can be reconstructed (i.e., if samples are diluted to bring results into the linear dynamic range, or re-extracted for QC failures the course of analysis is to be detailed in the narrative.) Where manual integration is used, the rationale for the manual integration and a list of affected sample results are to be included.

- Chain-of Custody Documentation: The data package is to include legible copies of chain-of-custody forms for each sample, and cooler receipt checklists for each cooler. Cooler checklists are to be associated with the corresponding chain-of-custody form. Any internal laboratory tracking document is to be included.
- Summary of Environmental Results: For each environmental sample analysis this summary should include field sample number and corresponding laboratory sample number, sample matrix, date of sample digestion (if applicable), date and time of analysis, identification of the instrument used for analysis, instrument specifications, weight or volume of sample used for analysis/digestion, dilution or concentration factor used for the sample extract, percent moisture in the sample, method detection limit or sample quantitation limit, definitions of any data qualifiers used, and analytical results.
- Summary of QC Results: The following QC results are to be presented in summary form. This summary should include the field sample number and corresponding laboratory sample number, sample matrix, date of sample digestion (if applicable), date and time of analysis, identification of the instrument used for analysis, instrument specifications, weight or volume of sample used for analysis/digestion, dilution or concentration factor used for the sample extract, percent moisture in the sample, method detection limit or sample quantitation limit, definitions of any data qualifiers used, and analytical results. QC acceptance limits are to be provided with the data. Summaries are to be presented on CLP standard forms. Submission of standard instrument output alone is unacceptable to satisfy this requirement.
 - Instrument Calibration: The order of reporting of calibrations for each analyte must follow the temporal order in which the standards were analyzed.
 - Initial Calibration: The source of the calibration standards, true value concentrations, found concentrations, the parent recovery for each element analyzed, and the date and time of analysis are to be reported.

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- Continuing Calibration Verification: The source of the calibration standards, true value concentrations, found concentrations, the percent recovery for each element analyzed, and the date and time of analysis are to be reported.
- Method Blank Analyses: The concentrations of any analytes found in initial calibration blanks, continuing calibration blank, and in the preparation blank are to be reported. The date and time of analysis are to also be reported.
- Interference Check Sample: The source of the interference check sample, true value concentrations, the percent recovery for each element analyzed, and the date and time of analysis are to be reported.
- Matrix Spikes and Duplicates: For matrix spike analyses the sample results, spike sample results, percent recovery, the spiking solution used, and the control range for each element are to be detailed. For post digestion spikes the concentration of the spiked sample, the sample result, the spiking solution added, percent recovery and control limits are to be detailed. For laboratory duplicates the original concentration, duplicate concentration, relative percent difference, and control limits are to be detailed. Date and time for all analyses are to be recorded.
- Laboratory Control Samples: The source of the laboratory control sample, true value concentrations, found concentrations, the percent recovery for each element analyzed, and the date and time of analysis are to be reported.
- Method of Standard Additions (MSA): This summary must be included when MSA analyses are required. The absorbance values and the corresponding concentration values, the final analyte concentrations, and correlation coefficients are to be reported for all analyses. Date and time of analysis are to be recorder for all analyses.
- ICP Serial Dilution: The initial and serial dilution results with percent difference are to be reported.
- ICP Linear Ranges: For each instrument and wavelength used the date on which the linear range was established, the integration time, and the upper limit concentration are to be reported.
- ICP Interelement Correction Factors: For each instrument and wavelength used the date on which correction factors were determined are to be reported. Specific correction factors for Al, Ca, Fe, Mg, and any other element and the compounds to which they are applied are to be detailed.

- Instrument Detection Limits: Results of the most current detection limit study are to be provided in the raw data package.
- Analysis Record: Analysis logs for all instrument used for analysis of project samples are to be provided indicating the date and time of analysis of project samples and the associated laboratory QC samples (initial calibration, continuing calibration check, method blank, matrix spikes, etc.).

2.5.3.2.1.3 Raw Data

Legible copies of raw data are to be organized systematically on numbered pages. The raw data for compound identification and quantitation are to be sufficient to support the results presented in other sections of the data package. This section of the data package is to include legible copies of the raw data for environmental samples (arranged in increasing order of field ID), instrument calibrations, QC analyses, sample extraction and cleanup logs, instrument analysis logs for each instrument used. Instrument analysis logs are particularly important since they provide the basic link between all sample analyses and QC information (calibrations, matrix spikes, etc.). Instrument analysis logs for all instruments used for sample analyses for this project are to be provided for all days on which analysis was performed. The raw data for each analysis are to include measurement print outs and quantitation reports for each instrument used. Records of absorbance, titrimetric or other measurements for wet chemical analysis are to be included. Raw data are to be presented on standard forms and accompanied by the instrument output. Use of CLP standard forms is not necessary; however, submission of standard instrument output alone is unacceptable to satisfy the requirements for raw data packages.

2.5.3.2.2 Electronic Data Deliverable

Electronic data deliverables (EDDs) are required for 100 percent of samples analyzed by the contract laboratory. The EDDs are to be submitted by the contract laboratory to the Project Manager for review. EDDs are to be prepared as prescribed below.

- Field Sample Number
- Chemical Name
- CAS No
- Value
- Units ($\mu\text{g/L}$ or $\mu\text{g/kg}$)
- Laboratory Qualifiers

- Extraction Method
- Analytical Method
- Date Extracted
- Date Analyzed
- Practical Quantitation Limit [PQL] ($\mu\text{g/L}$ or $\mu\text{g/kg}$)
- PQL units
- Method Detection Limit [MDL] ($\mu\text{g/L}$ or $\mu\text{g/kg}$)
- MDL units
- Sample Delivery Group or Data Package Identification

2.5.4 Independent Data Validation

Data validation is the process whereby data are determined to be of acceptable or unacceptable quality based on a set of predefined criteria. These criteria depend upon the type(s) of data involved and the purpose for that data are collected.

A review of 100% of the data will be performed by an independent third party (ECT.Con, Inc.). Data packages will be validated to ensure compliance with specified analytical, QA, and data reduction procedures; data reporting requirements; and required accuracy, precision, and completeness criteria. Validation will be performed in accordance with USEPA Region III Levels IM1 for inorganics and M2 for organics as defined in USEPA Region III document "Innovative Approaches to Data Validation" (USEPA, 1995).

2.6 Analytical Quality Control

Quality control checks will be performed to ensure the collection of representative samples and the generation of valid analytical results on these samples. These checks will be performed by project participants through the program under the guidance of the QA Officer.

2.6.1 Data Collection and Sampling QC Procedures

The internal QC checks for the sampling aspects of this program will include, but will not be limited to, the following:

- Use of field notebooks and field activity forms to ensure completeness, traceability, and comparability of the samples collected;
- Field checking of field notebooks, field activity forms, and sample labels by a second person to ensure accuracy and completeness;
- Strict adherence to the sample chain-of-custody procedures outlined in Section 2.4.6 of the DCQAP; and,
- Submission of field blanks and equipment rinsates.

2.6.1.1 Trip Blank Analysis

Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial. Therefore, trip blanks will be analyzed to monitor for possible sample contamination during shipment. Trip blanks are prepared by filling two vials from organic-free water and shipping the blanks with the field kit. Trip blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples. Following the analyses, if the trip blanks indicate possible contamination of the samples, the results will be used to flag sample data with appropriate qualifiers. Results of trip blank analyses should be maintained with the corresponding sample analytical data in the project file.

2.6.1.2 Method Blank Analysis

A method blank is a volume of deionized, distilled laboratory water carried through the entire analytical procedure. The volume of the blank must be approximately equal to the sample volume processed. A method blank should be performed with each group of samples. Analysis of the blank verifies that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware are known and minimized. Optimally, no target compounds should be detected in a method blank. Results of method blank analyses will be maintained with the corresponding analytical data in the project file.

2.6.1.3 Duplicate Sample Analysis

Duplicate analyses are performed to evaluate the precision of an analysis. Results of the duplicate analyses are used to determine the relative percent differences between replicate samples. Field (blind) duplicate samples will be taken for each matrix (soil,

groundwater, surface water and sediment). Duplicate analysis results will be summarized on the quality control data summary form.

2.6.1.4 Verification/Reference Standard

On an annual or semiannual basis, the laboratory manager should introduce a group of prepared verification samples, or standard reference materials, into the analytical testing regime. Results of these data should be summarized, evaluated, and presented to laboratory management for internal review and corrective actions, if appropriate.

2.6.1.5 Other Laboratory quality Control Checks

Quality control checks will be performed to ensure the collection of representative samples and the generation of valid analytical results on these samples. These checks are performed by project participants under the guidance of QC personnel. Detailed Standard Operating Procedures (SOP) will be maintained by the laboratory and made available for inspection.

The laboratory will make use of different types of QC samples to document the validity of the generated data. The following types of QC samples are routinely used:

- Calibration Check Samples: A calibration standard prepared from a source other than the one used for the calibration standards that is used periodically to check the original calibration. Alternately, an independent concentration may be prepared from the calibration standards.
- Spiked Samples: Replicate aliquots of project samples are spiked with components of interest and carried through the entire preparative and analytical scheme.
- Laboratory Control Samples (LCS) (or blank spike samples): These samples are prepared from EPA Environmental Monitoring Systems Laboratory (EMSL) concentrates or NIST standard reference materials. The LCS is used to establish that an instrument or procedure is in control. A LCS is normally carried through the entire sample preparation and analysis procedure.
- Matrix Spikes/Matrix Spike Duplicates (MS/MSD): One MS/MSD pair will be run per 20 samples for each different matrix analyzed. These pairs will be spiked with the target compounds of concern for that matrix.

Values that fall outside the QC limits described in the analytical method will be noted. The following guidelines will be used at the laboratory to check recovery values that fall outside the QC limits:

- Recovery data are evaluated to determine if the QC limits are appropriate and if a problem may exist even though the limits are being achieved (e.g., one compound that is consistently barely within the lower limit);
- Recovery data that are outside the established limits are evaluated. This evaluation includes an independent check of the calculation; and,
- Corrective action is performed if the following are observed:
 - All recovery values in any one analysis are outside the established limits.
 - Over 50 percent of the values for a given sample set are outside the limits.
 - One compound is outside the limits in over 50 percent of the samples.
- Reagents used in the laboratory are normally of analytical reagent grade or higher purity; each lot of acid or solvent used is checked for acceptability prior to laboratory use. Reagents are labeled with the date received and date opened. Glassware is precleaned according to specifications contained in the analytical method. Standard laboratory practices for laboratory cleanliness, personnel training, and other general procedures are used.

2.6.2 Preventive Maintenance

Field equipment used by the field technicians, that requires preventative maintenance, will be serviced as described in the Operator's Manual for each instrument. Laboratory instrumentation will be serviced as stated in the laboratory's generic QAP (Appendix D). Records of calibration and maintenance activities for each piece of equipment will be maintained in FEL.

2.6.3 Corrective Action

Corrective action will be initiated through the development and implementation of routine internal quality control checks. Specific limits beyond that corrective action is required will be established for each system. Corrective actions for identified deficiencies are to be documented, tracked, and verified. Corrective actions are required for the following conditions:

- QC data outside the defined acceptance windows for precision or accuracy;

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- Blanks or Laboratory Control Samples (LCSs) that contain contaminants above practical quantitation limits;
- Undesirable trends are detected in spike or surrogate recoveries or Relative Percent Difference (RPD) between spiked duplicates;
- Unusual changes in method detection limits; and
- Deficiencies are identified during internal or external audits or from the results of performance evaluation samples.

Corrective actions are to be implemented at the most appropriate operational or management level. To the extent practical, analytical corrective actions are to be implemented at the bench level by the technician/analyst. If the problem persists or cannot be resolved at this level, the matter is to be elevated to the appropriate manager until resolution.

Documentation for corrective actions implemented by the contract laboratory is to be generated and retained in the laboratory's project file. This documentation is to be made accessible to the Task Manager and retained per applicable contractual requirements. A description of relevant corrective actions is to be included in the narrative that accompanies each data package.

Unless otherwise specified to the laboratory by the Project Manager or designee, the following corrective actions should be taken.

- Incoming Samples: Problems noted during sample receipt are to be documented on the Cooler Receipt Checklist. The Task Manager is to be notified for problem resolution.
- Sample Holding Times: If maximum holding times are or may be exceeded by the laboratory, the Task Manager is to be notified for problem resolution.
- Instrument Calibration: Sample analysis may not proceed until initial calibrations meet defined criteria. Calibrations must meet method time requirements or re-calibration must be performed. Continuing calibrations that do not meet defined criteria will result in reanalysis of the appropriate calibration standard(s) and re-analysis of affected samples back to the last passing continuing calibration verification.
- Practical Quantitation Limits: Appropriate sample clean-up procedures are to be employed to attempt to achieve the practical quantitation limits as stated in the following instructions. If difficulties arise in achieving these limits due to a

particular sample matrix, the contract laboratory should notify the Task Manager of this problem for resolution. Dilutions are to be documented in the case narrative along with the revised practical quantitation limits for those analytes directly affected. Analytes detected above the method detection limits but below the practical quantitation limits are to be reported as estimated values.

- Method QC: Results related to method QC, including blank contamination, duplicate measurement reproducibility, MS/MSD recoveries, surrogate recoveries, LCS recoveries, and other method-specified QC measures are to meet the project requirements as specified in this plan. Otherwise, the affected sample(s) are to be reanalyzed and/or re-extracted/re-digested and reanalyzed within method-required holding times to verify the presence or absence of matrix effects. In order to confirm matrix effects, QC results must observe the same direction and magnitude (ten times) bias. If matrix effect is not confirmed, then the entire batch of samples may have to be reanalyzed at no cost to the government. CEC is to be notified as soon as possible to discuss possible corrective actions if unusually difficult sample matrices are encountered.
- Calculation Errors: Reports are to be reissued if calculation and/or reporting errors are noted with any given data package. The case narrative is to state the reason(s) for re-issuance of a report.

2.7 REFERENCES

United States Environmental Protection Agency (USEPA). 1987. Data Quality Objectives for Remedial Response Activities. EPA 540/6-87/003.

United States Environmental Protection Agency (USEPA). 1993. Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses. April.

United States Environmental Protection Agency (USEPA). 1994. Region III Modifications to National Functional Guidelines for Organic Data Review Multi-Media, Multi-Concentration (OLMO1.0-OLMO1.9). Central Regional Laboratory, Annapolis, Maryland. September.

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United States Environmental Protection Agency (USEPA). 1995. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Update III.

United States Environmental Protection Agency (USEPA). 1996. Drinking Water Regulations and Health Advisories. Office of Water. EPA 822-B-96-002. October.

United States Environmental Protection Agency (USEPA). 1999. Region III Risk-Based Concentration Table. April.

3. DATA MANAGEMENT PLAN

3.1 Data Management Procedures

CEC will adhere to stringent data management procedures for field activities, sample management and tracking, and document control and inventory. Data management protocols are to ensure data integrity and security at each stage of data processing. This section of the workplan provides guidance and requirements for these procedures. Overall the Field Operations Leader will coordinate field data management. Chemical data management will also be the responsibility of the Field Operations Leader. The following are general objectives of data management in support of planned WPSC RFI data collection and field activities.

- Track samples from the field to analytical laboratories and delivery of preliminary and final analytical results to the WPSC Database.
- Generate laboratory protocols and electronic formats for data deliverables and provide guidance to analytical laboratories to insure integrity and completeness.
- Disseminate and present environmental data and facilitate information in textual and map forms.

3.1.1 Field Data Collection and Recording

During field investigations, consistent documentation and accurate record keeping procedures are critical. Data management procedures for field investigations at the WPSC site include the following:

Data Collection Quality Assurance Plan (DCQAP): Provides procedures and protocols for records responsibility; nonconformity events; corrective measures; and data deficiencies. The DCQAP for the WPSC site is presented in Section 2.0 of this RFI Workplan.

Data Security System and Chain-of-Custody: The DCQAP describes strict chain-of-custody procedures that will be followed in the field and through sample analysis at the selected laboratory. Chain-of-custody records will be maintained with other data in a locked file cabinet by the Project Manager at the CEC Export, Pennsylvania office.

Site Field Book and Field Logs: The site field book and field logs maintained daily by the field personnel will be the primary record for field investigation activities. Field logs will include a description of any modifications to the procedures outlined in the RFI Workplan, with justification for such modifications. Field measurements and observations will be recorded directly into the project log books or field activity forms. Examples of field measurements include VOC headspace analysis and visible soil conditions. Health and safety monitoring, sampling locations, sampling techniques, and a general description of daily activities are typically included in the daily log. Any unusual occurrences or circumstances will be documented in these logs for reference in determining the possible causes for data anomalies discovered during data analysis. Data will be recorded directly and legibly in field log books or field log forms with entries signed and dated. Changes made to original notes will not obliterate the original information and will be dated and signed. Standard format information sheets will be used whenever appropriate and will be retained in the permanent project file.

3.1.2 Sample Management and Tracking

The Project Manager will maintain records of the following:

- sample shipments
- receipt of analytical results
- submittal of preliminary results for QA/QC review
- results of the QA/QC review, and
- evaluation of the QC package from the laboratory.

The objective is to ensure only validated data with final approval are used in site analysis. When samples are collected, field personnel will complete documentation required by this DQCAP, including chain-of-custody forms. At the close of the field effort, hard copies of all field log books and chain-of-custody forms for samples collected will be sent to CEC's Export office for retention.

Data generated by the contract laboratories will be transmitted to CEC in electronic and hard copy formats. Electronic data deliverables (EDD) and hard copies provided by the laboratory are duplicates of the original data generation. The originals will be archived at the laboratory for the duration of the project or a minimum of five years.

Analytical data (EDD format) uploaded to the WPSC database will be quality controlled in two stages: 1) during upload to ensure data integrity; and 2) after upload by correlating database output listings with chain of custody forms and accompanying hard-copy laboratory reports for data continuity. In this latter QC stage, laboratory identifications that are different from field identifications will be checked along with other attributes. Fields associated with the WPSC database are listed on Table 12.

The Project Manager is responsible for data tracking and data validation processes. The data base administrator is then responsible for entering the data qualifiers into the database and informing potential data users that the validation has been completed and the validation information has been entered into the database.

Preliminary data, clearly identified as such, may be used to prepare internal review documents, to begin data analysis, and to narrow potential Phase II investigation activities, if required. The RFI Report will clearly identify all validated data and will be accompanied by QA/QC comments and data.

3.1.2.1 Sample Identification and Chain-of-Custody

3.1.2.1.1 Sample Identification

A sample numbering system has been established and will be implemented to identify both environmental and quality control samples collected and submitted for analysis. The purpose of the numbering system is to assist in the tracking of samples and to facilitate retrieval of analytical results.

Each sample will be assigned a unique sample identification number using the following format:

- [Sample Type & Sector]-[Sequential Sample Number]-[Matrix]-[Sample Depth]

Codes for common sample types are as follows:

- Sample Type –
 - SD - Sediment
 - SW - Surface Water
 - MW - Monitoring Well
 - SB - Soil Boring
 - GP - Geoprobe
 - SP - Seep
 - WW - Wastewater
- Sector – A through H
- Matrix –
 - W - Water
 - S - Solid
 - Depth Interval – 0.1, 0.2, etc.

The Location code will identify the sample type and sector within which the sample is associated followed by the sample point identification. The matrix will identify whether the sample is a water (W) or a solid (S) sample. The depth interval will be used for soil samples only and will be posted in feet and will be accurate to the 0.1 ft. An example sample identification of a groundwater sample collected from MW4 in Sector B would be identified as such:

- MWB4W

The Field Operations Leader will coordinate sample analysis with the laboratory. The laboratory uses standard chain-of-custody procedures for sample tracking that have been approved by USEPA (SW-846). Chain-of-custody procedures are described further in the DCQAP. A sample custodian continues the chain-of-custody by assigning a

laboratory control number to each sample. The control number, along with the number assigned in the field, accompanies the sample through analysis, and back to the field coordinator with the analytical results.

3.1.3 Reporting of Analytical Results

Data reporting procedures for the laboratory are provided in the SW-846 (USEPA, 1986) and in the DCQAP. These procedures yield analytical data and QA/QC summaries. The laboratory's procedures are briefly outlined below:

Manual Recording: The Laboratory's Standard Operating Procedures describe the QC procedures used for laboratory notebooks and include data worksheets that are routinely used in the reduction of quantitative instrument data to a report format expressed in terms of concentrations. Instrumental data are entered on summary worksheets using microcomputers and appropriate software.

Automated Recording: Many analytical measurements at the laboratory are automatically recorded and have their own computerized data systems. The laboratory instrument checklists include checks on the operation of these data handlers and internal validity checks are used to flag data resulting from electronic interferences.

Calculation of Results: Whenever possible, calculations are computerized for efficiency and to avoid human error. The analytical data systems mentioned above calculate results as programmed and provide hard copy in the desired format. In all cases, computerized data are verified for error control, and careful handling of computer storage peripherals is stressed. Tests are built into the programs to trap transcription errors or missing items. The record of the run contains the calculation results and the input data. Analytical results are reduced to the correct number of significant figures for the measurement technique.

Data Review: Acceptable limits are provided to help the operator identify questionable data and control charts are used whenever possible to show if the procedure is in control. The laboratory's QC Coordinator initiates control charts for instrument performance and specific analytical methods, and reviews routine and specialized QC sample results as they pertain to each project.

Data Validation: Data validation is the process of filtering data and accepting or rejecting it on the basis of sound criteria. Records of all data are maintained, even those

judged by "outlying" or spurious values. Usually acceptable limits or control chart limits are used as the rejection criteria. Analytical data are validated using the following general criteria:

- Documentation of sample identification and handling, e.g., preservation and required analyses;
- Use of approved analytical procedures;
- Use of QC checked reagents;
- Use of known QC samples (Laboratory Control Samples) to ensure that the analytical system was in control;
- Analysis of required blanks, duplicates, and blind QC samples completed; and
- Precision and accuracy achieved on replicate and blind QC samples.

3.1.4 Document Control

A document inventory and filing system will be established for the RFI project. The Project Manager will have responsibility for document control. All originals will be maintained in the central files. Project staff will make copies of documents, as needed, and return the originals to central file.

Hard copies of all chemical data packages will be managed by the Project Manager and archived in project files. Field data archival also will be the responsibility of the Project Manager.

Contract laboratories are to preserve information regarding sample analysis (calibration records, etc.) such that analytical processes can be reconstructed. The contract laboratories will maintain data associated with the project for the duration of the project or a minimum of five years following the submittal data package.

3.2 Data Reduction

The following sections provide an overview of the data reduction processes that will occur after the field investigation data has been collected. The procedures described in the following sections are standard procedures and will likely be modified according to the results, so that the data may be presented in a manner that is logical and most suited to the site conceptual model.

3.2.1 Tabular Displays

The laboratory analytical data package will be reduced such that an appendix to the RFI Report will be created to present the raw data result sheets only. This will allow the reader to readily review raw data results by sample ID, without having to sort through QA/QC data. This appendix will also serve as the basis for data included in summary tables.

Initially, validated data will be assembled into separate tables that will be sorted by medium. For example, separate occurrence tables of validated data will be generated for groundwater, surface water, sediment, and soil. Average, minimum and maximum constituent concentrations will be presented. These data tables will likely be further sorted by RFI Sector. For example, data associated with the Hillside Area would be presented in a separate table. Based on the results, additional data tables may be generated that present validated data by media and aquifer zone. For example, separate data tables may be generated for the groundwater results to compare the perched aquifer versus the upper alluvial aquifer versus the lower alluvial aquifer.

Other tabular displays that will likely be generated as part of the RFI Report include, but are not limited to:

- Database summary;
- Monitoring well construction information;
- Summary of aquifer properties;
- Human health risk data;
- Flora and fauna survey data; and
- Ecological risk data;

3.2.2 Graphical Displays

All sampling locations will be illustrated on a site map in areal view. Figures will be generated that display levels of contamination at each sampling location. These figures will likely be separated by media in the same manner as the tabular displays. For example separate figures will be generated for groundwater, surface water, sediment, and soil data. Additional figures will likely be generated that display constituent concentrations vertically and/or horizontally, which may be organized by media, aquifer zone, or constituent type; the actual content and number of figures to be generated that display constituent concentrations will depend on the results of the data collected.

Other figures that will likely be generated as part of the RFI Report include, but are not limited to:

- Site investigation layout information;
- Hydrogeological maps and cross sections; and,
- Vertical and Horizontal groundwater flow data.

3.3 Reporting Requirements

3.3.1 Progress Reporting

WPSC will prepare bimonthly progress reports for submission to USEPA outlining major accomplishments during the reporting period, and activities to be started or completed during the upcoming reporting period.

3.3.2 RFI Report

WPSC will prepare a RFI report that documents the field investigation activities, the results of the field data and the analytical data, and the baseline risk assessment. Section 3.2 entitled, Data Reduction provides additional detail regarding the presentation and content of the RFI Report. The RFI report will also include recommendations for any additional Phase II type field activities necessary for completion of the RFI portion of the RCRA corrective action process.

4. COMMUNITY RELATIONS PLAN

In accordance with RCRA guidance, the establishment of two-way communication between WPSC and the community should be maintained throughout the Corrective Action process. This communication ensures that the community understands the intent of the environmental work being conducted and reduces the chance for any conflict resulting from lack of information, misinformation, or speculation. WPSC has an established Community Outreach Program in place. Periodic meetings are held in Follansbee in the municipal library bringing together WPSC management, municipal representatives, and the general public. These meetings offer representatives the opportunity to discuss a wide range of issues related to plant operations and their impact on the community. WPSC will utilize these community outreach meetings to keep the community informed as to ongoing environmental activities under the RCRA Corrective Action Process.